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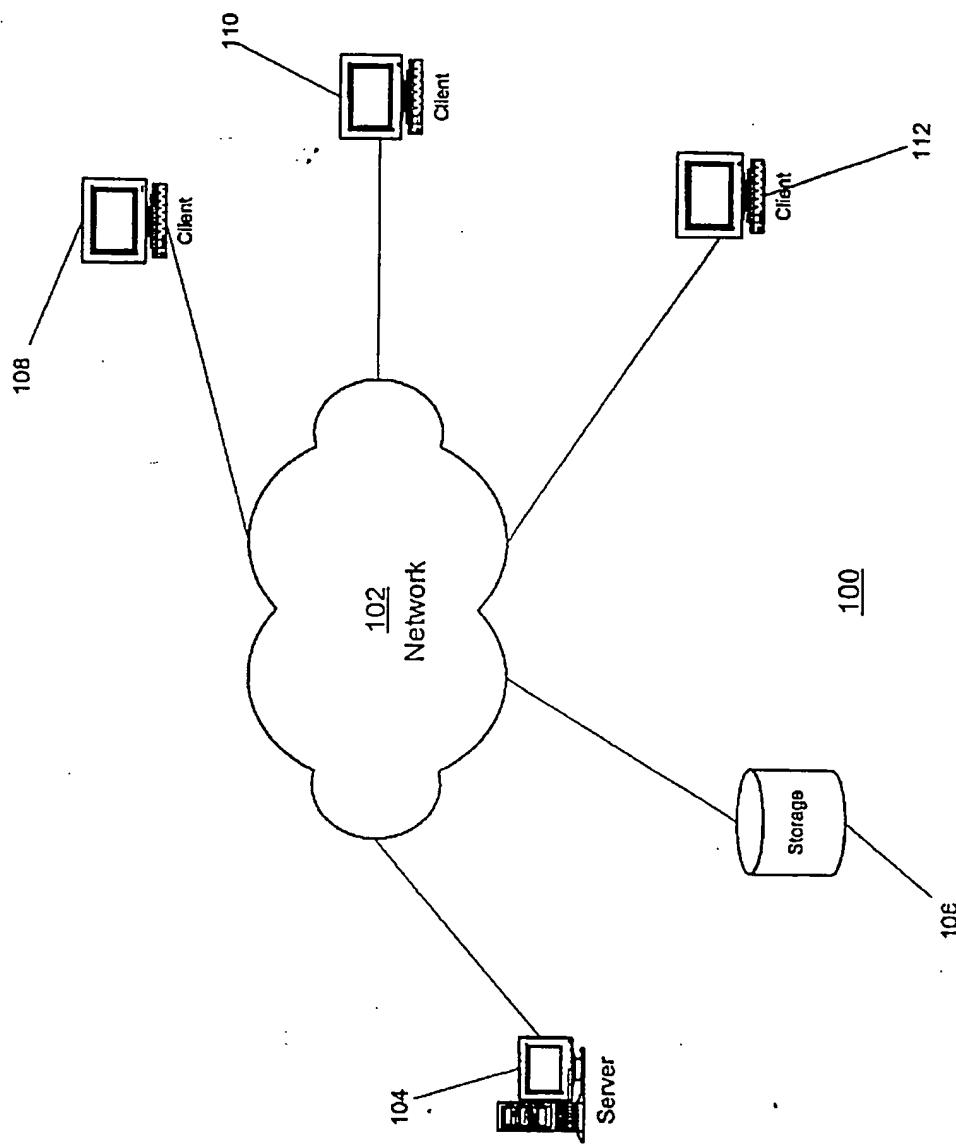
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Figure 1



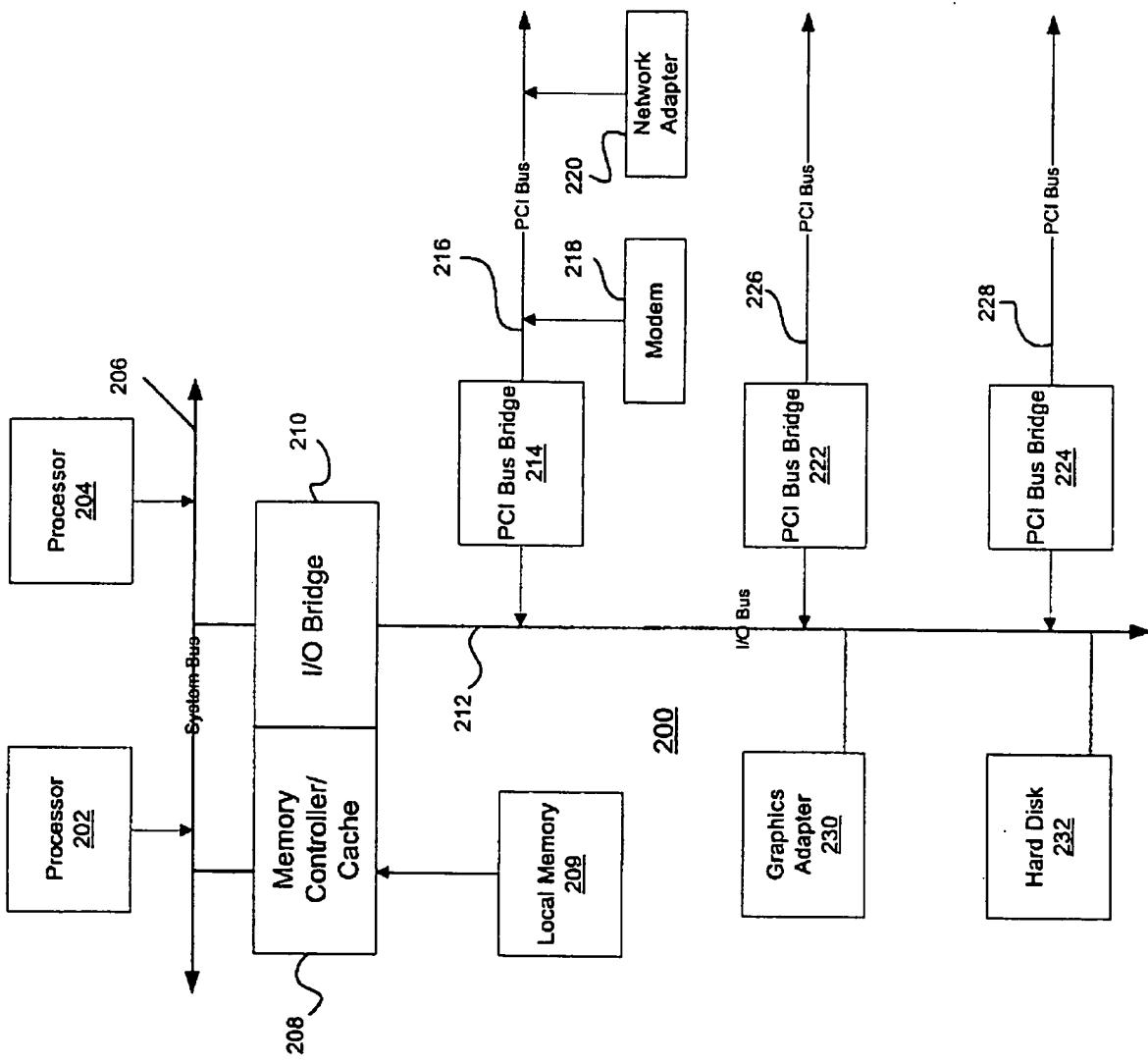


Figure 2

server

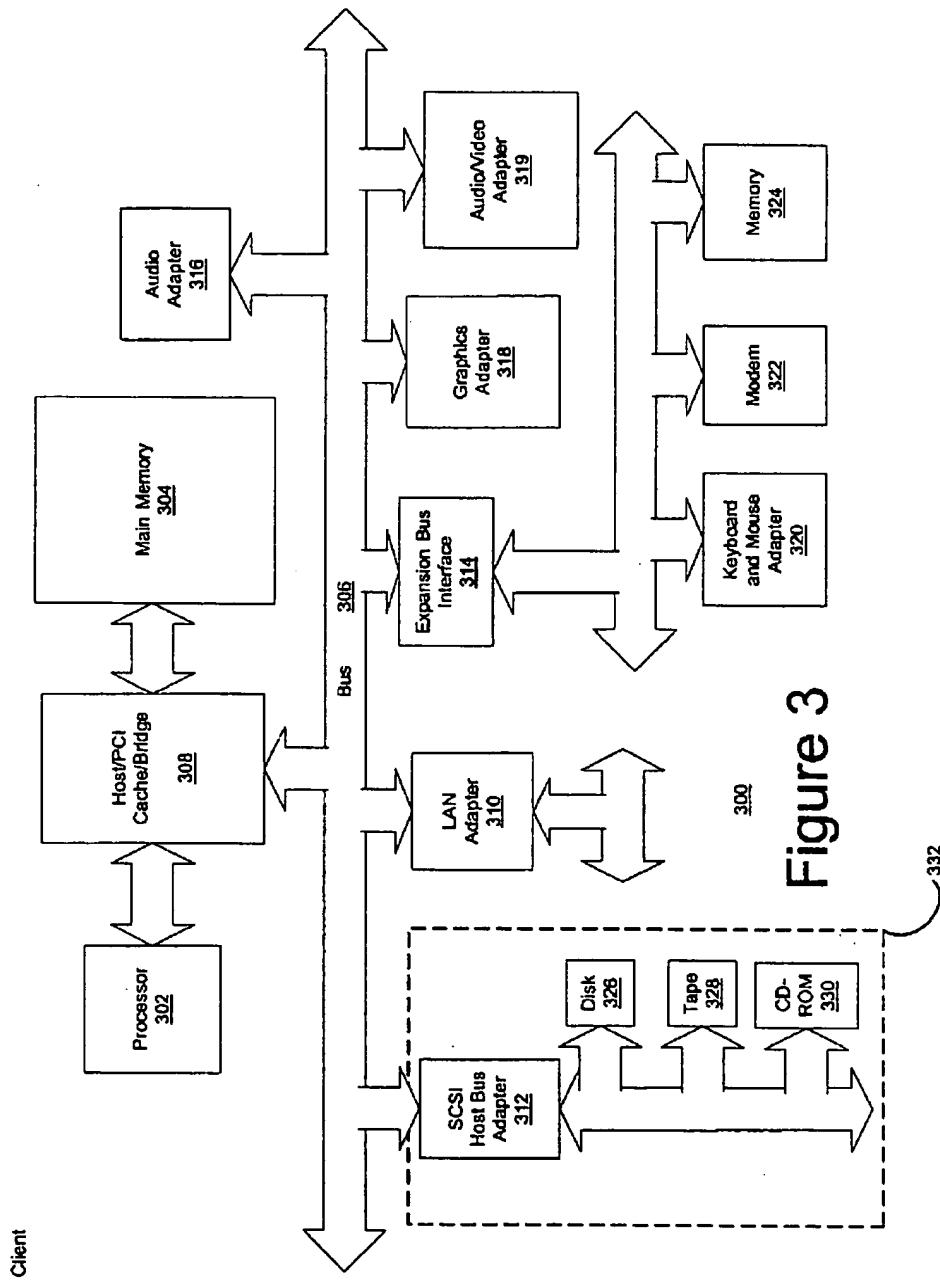


Figure 3

Figure 4

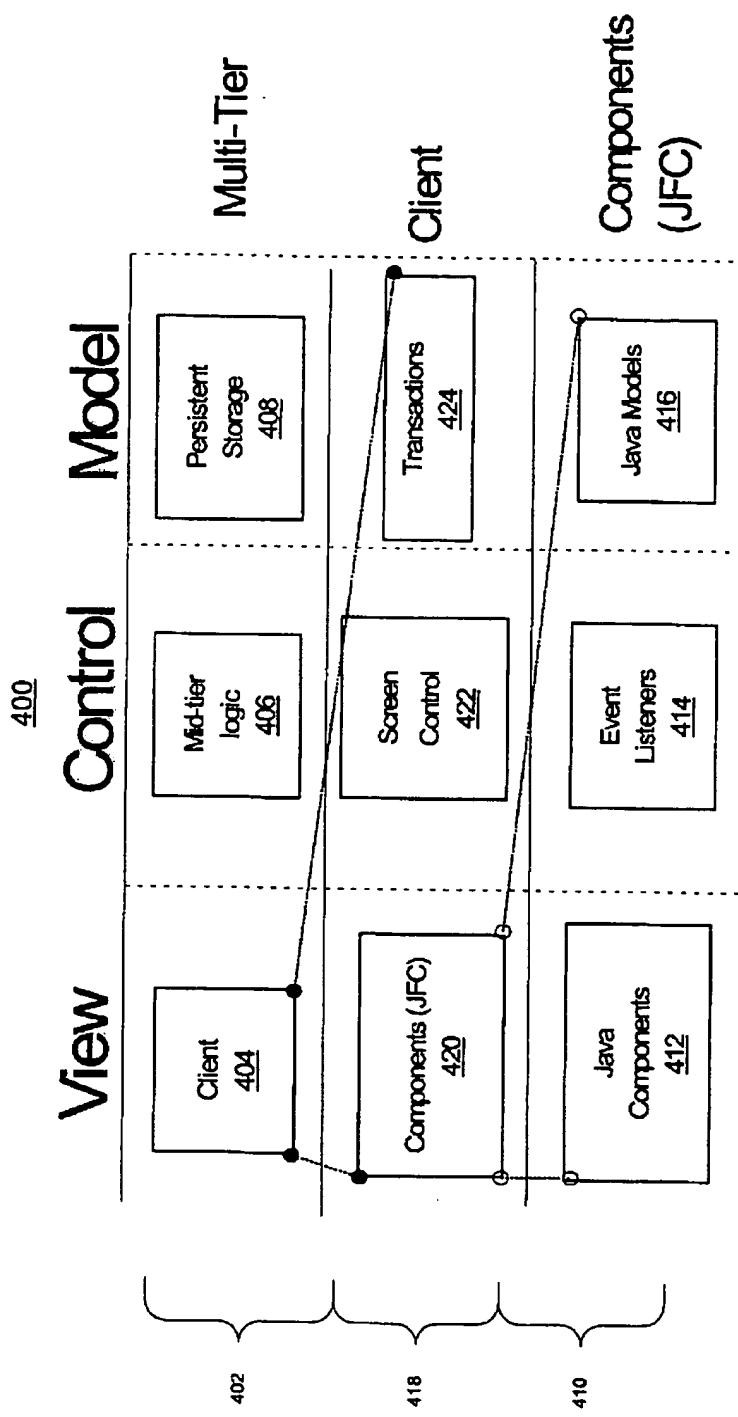


Figure 5

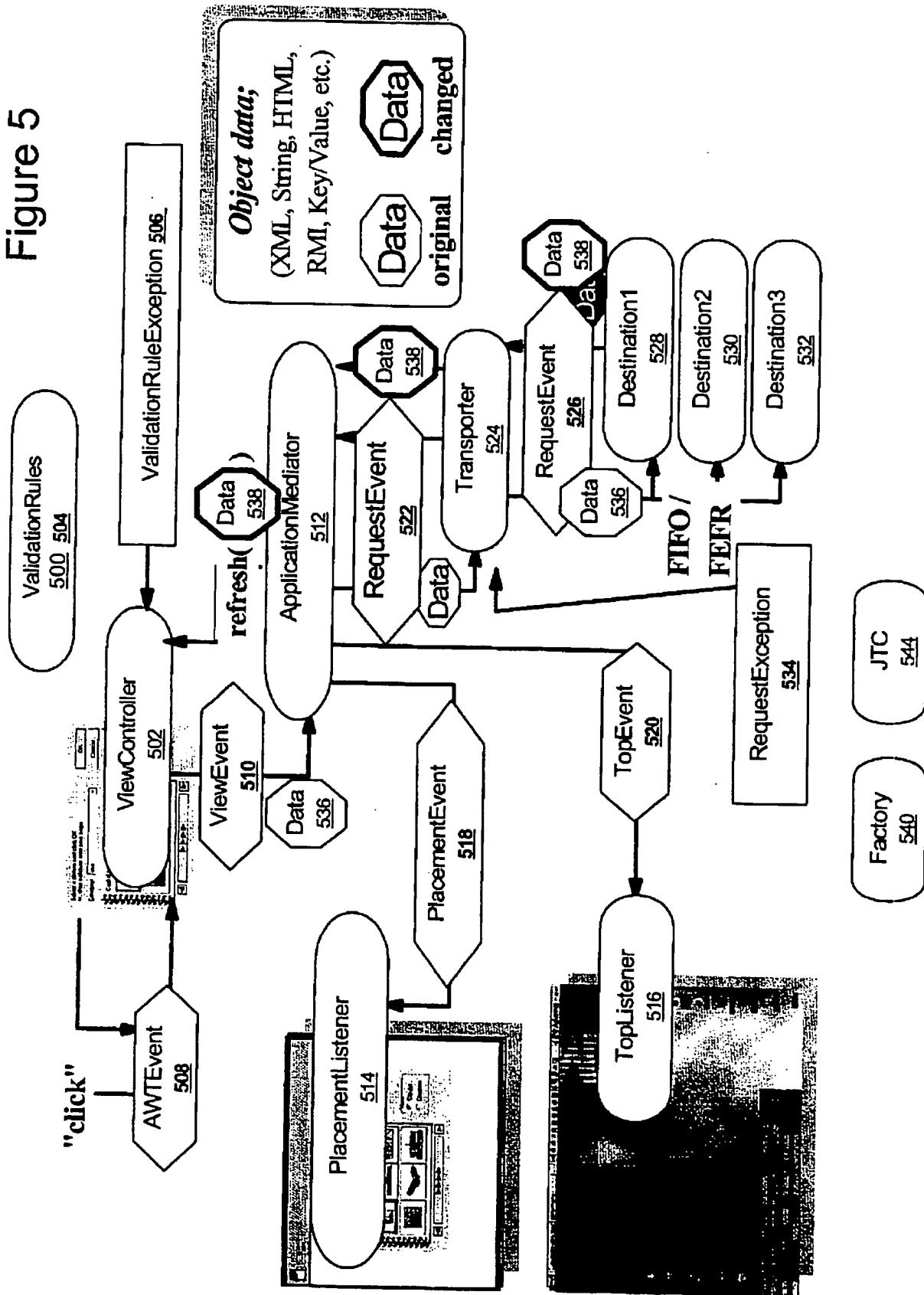


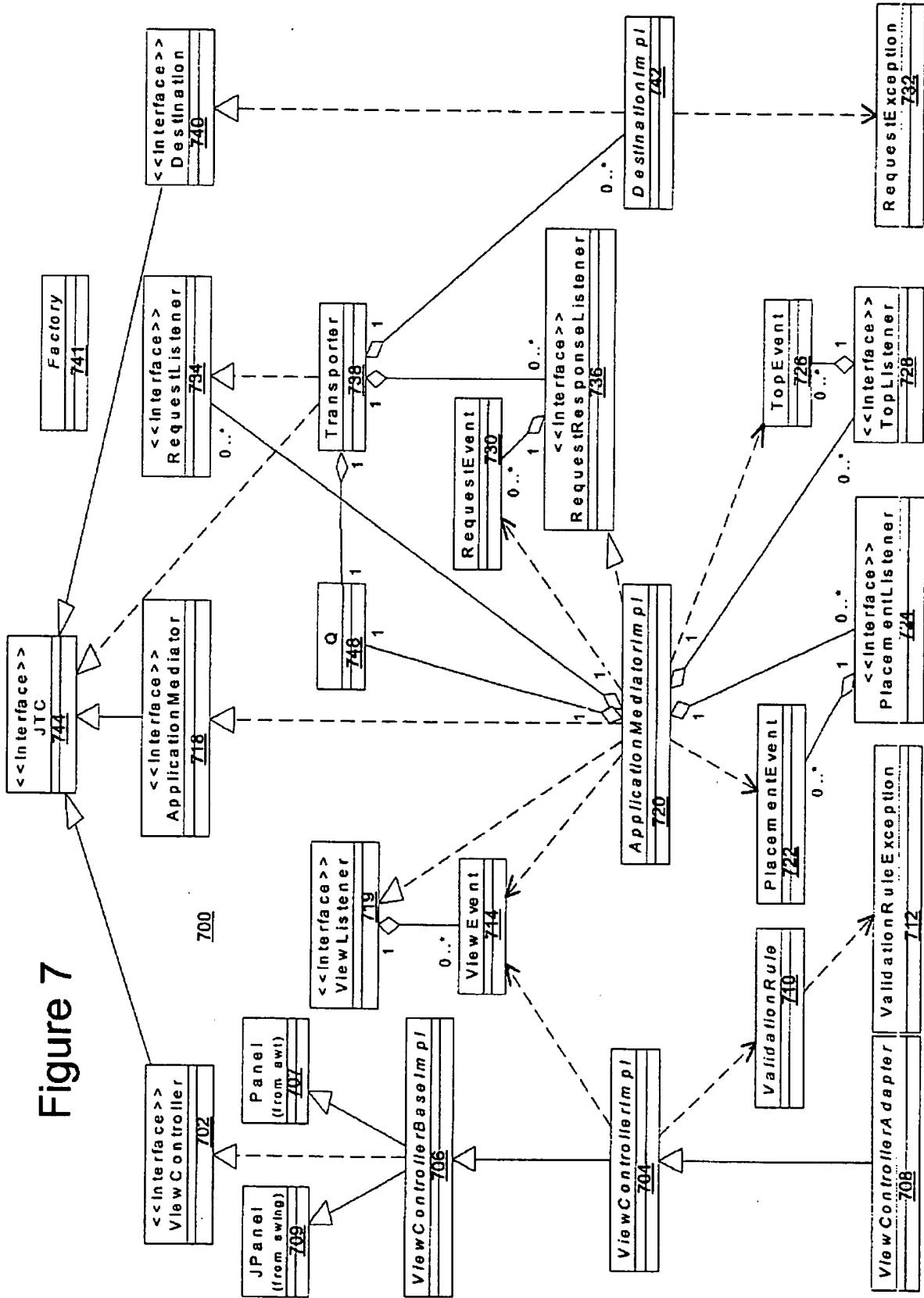
Figure 6

600

Class Hierarchy

```
class java.lang.Object
interface com.ibm.jtc.ApplicationMediator (extends com.ibm.jtc.JTC)
class com.ibm.jtc.ApplicationMediatorImpl (implements com.ibm.jtc.ApplicationMediator,
com.ibm.jtc.ViewListener, com.ibm.jtc.RequestResponseListener)
interface com.ibm.jtc.Destination (extends com.ibm.jtc.JTC)
class com.ibm.jtc.DestinationImpl (implements com.ibm.jtc.Destination)
class java.util.EventObject (implements java.io.Serializable)
class com.ibm.jtc.PlanmentEvent (implements java.io.Serializable)
class com.ibm.jtc.RequestEvent (implements java.io.Serializable)
class com.ibm.jtc.TopEvent (implements java.io.Serializable)
class com.ibm.jtc.ViewEvent (implements java.io.Serializable)
class com.ibm.jtc.Factory (implements java.io.Serializable)
interface com.ibm.jtc.JTC (extends java.io.Serializable)
interface com.ibm.jtc.PlanmentListener
interface com.ibm.jtc.RequestListener
interface com.ibm.jtc.RequestResponseListener
class java.lang.Throwable (implements java.io.Serializable)
class java.lang.Exception
class com.ibm.jtc.RequestException (implements java.io.Serializable)
class com.ibm.jtc.ValidationRuleException (implements java.io.Serializable)
interface com.ibm.jtc.TopListener
class com.ibm.jtc.Transporter (implements com.ibm.jtc.RequestListener, com.ibm.jtc.JTC)
class com.ibm.jtc.ValidationRule (implements java.io.Serializable)
interface com.ibm.jtc.ViewController (extends com.ibm.jtc.JTC)
interface com.ibm.jtc.ViewListener
```

Figure 7



ViewController

Variables

Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines, Inc., 1997 1998 1999. All rights reserved.

800

FIGURE 8A

Methods

Name	Declaration	Description
addViewListener	public abstract void addViewListener (ViewListener listener)	Invoked when a ViewListener is added
getComponent	public abstract Component get Component ()	Invoked when the ViewController as a component is needed
getPermissions	public abstract String[] getPermissions ()	Invoked when the ViewController permission keys are needed
isValid	public abstract boolean isValid ()	Invoked when a ViewController's GUI state needs to be checked to see if it is valid
isVisible	public abstract boolean isVisible ()	Invoked to see if the ViewController is visible
refresh	public abstract void refresh (Object data)	Invoked to supply new or changed data
removeViewListener	public abstract void removeViewListener (ViewListener listener)	Invoked to remove a ViewListener
setPermissions	public abstract void setPermissions (Hashtable permissions)	Invoked to set the permissions keys and values
setProperties	public abstract void setProperties (Properties properties)	Invoked to set the properties
setResources	public abstract void setResources (ResourceBundle bundle)	Invoked to set the resources
setValidationLevel	public abstract void setValidationLevel (int level)	Invoked to give a <i>hint</i> to the ViewController as to what validation level to use. The value for level defined in this interface include: NONE = try to do no validation EVENT = try to do validation every event (key) FOCUS = try to do validation on focus change VIEWEVENT = try to do validation before a ViewEvent is issued.
setVisible	public abstract void setVisible (boolean visible)	Invoked to set the visibility

802

FIGURE 8B

Figure 9A *ViewControllerImpl*

Variables	900		
Name	Declaration	Description	
copyright	public static final String copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.	
validationLevel	protected int validationLevel	The current validation level	
viewEvent	protected ViewEvent viewEvent	A reference to a ViewEvent. Create one ViewEvent reuse it between events.	
data	protected Object data	An reference to the data	

Figure 9B

Constructors	902		
Name	Declaration	Description	
ViewControllerImpl	public ViewControllerImpl()	Default constructor.	

Figure 9C

904

ViewControllerImpl

Methods	Declaration	Description
<code>addViewListener</code>	<code>public final void addViewListener(ViewListener listener)</code>	Add a ViewListener.
<code>clear</code>	<code>public void clear()</code>	Clear local state by setting the data reference to null and by removing all ViewListeners.
<code>exit</code>	<code>public void exit()</code>	Get ready to exit. Clear local state by setting the data reference to null, removing all ViewListeners and setting view listeners to null.
<code>fireViewEvent</code>	<code>public final void fireViewEvent(ViewEvent event)</code>	If the ViewEvent is not null then send it to all ViewListeners.
<code>getComponent</code>	<code>public Component getComponent()</code>	Return the Component that is "this" ViewController. By default, "this" is returned. Redefine this method in ViewControllerBaseImpl when you have a non-Javadoc Component superclass.
<code>getJTCs</code>	<code>public Vector getJTCs()</code>	Return all JTC type objects defined. By default null is returned. Typically, ViewControllerBase will not return anything.
<code>getPermissions</code>	<code>public String[] getPermissions()</code>	Return a set "keys" that can a management system can use when assigning JTC function based on roles (i.e. group, user). For example, consider the common case of operator override. In a grocery store, if a cashier makes a mistake, a manager inserts a key or enters a password to enable more function on the cash register. The software analogy is that a button may become active or disabled. Suppose the ViewController implements a button labeled "Override" and it is the only component whose state can be visibly altered outside the ViewController. The ViewController writer will return: "Override" in this case, the only options are ENABLE or DISABLE. Suppose these constants are define to be 0x01 and 0x02, respectively. A management system that maintains user privileges is queried at runtime. The ViewController is then called with setPermissions(keys, values) where keys is "Override" and values is "0x01". The ViewController writer now responds to this request by turning off the button. Instead of hard coding the possible roles, the ViewController simply reacts to key/value settings. By default, nothing is returned.
<code>init</code>	<code>public void init()</code>	Initialize. By default, do nothing.
<code>isEnabled</code>	<code>public boolean isEnabled()</code>	Is this ViewController enabled?
<code>isValid</code>	<code>public boolean isValid()</code>	Is the ViewController in a consistent state? This usually means: Do all fields pass ValidationRules? The meaning could also be application specific. This value can provide other components with the ability to show a visual indicator, such as an X or a check in a tree menu indicating incomplete or partial data. The default value is true.
<code>isVisible</code>	<code>public boolean isVisible()</code>	Is this ViewController visible?
<code>refresh</code>	<code>public void refresh(Object data)</code>	Data objects are being passed in. By default, keep a reference to them. Interpretation of the data is performed in the subclass. For example, suppose the data being passed is a Customer object. Then a subclass can perform the following: This can be extended to more complex data types and data tree components (i.e. arrays, Vectors, etc.).
<code>removeViewListener</code>	<code>public final void removeViewListener(ViewListener listener)</code>	Remove a ViewListener.
<code>setEnabled</code>	<code>public void setEnabled(boolean toggle)</code>	Enable or disable the ViewController. Remember the state, and ask the ViewControllerBaseImpl to handle it.
<code>setPermissions</code>	<code>public void setPermissions(Hashtable permissions)</code>	Given a set of keys and values, update the internal state of the ViewController. The keys and values are applied via a management system and relate to roles (i.e. users and groups). The possible values in the key/value pairs are application and ViewController specific. For example, create an interface to define the keys and values. public interface Customer { public static final String DETAILS = "DETAILS"; public static final String ON = "1"; public static final String OFF = "0"; } then ask the ViewController: Hashtable permissions = new Hashtable(); permissions.put(Customer.DETAILS, Customer.ON); The ViewController will interpret the meaning of ON and perform the necessary action, such as active a button. The meaning of keys, values and actions should be defined in a GUI sense. By default nothing happens.
<code>setProperties</code>	<code>public void setProperties(Properties properties)</code>	Set the properties. Default is to do nothing.
<code>setResources</code>	<code>public void setResources(ResourceBundle bundle)</code>	Set the ResourceBundle. Default is to do nothing.
<code>setValidationLevel</code>	<code>public void setValidationLevel(int level)</code>	Set the validation level to indicate when ValidationRules should be applied. Four constants are defined in the ValidationRule class:
		NONE COMPONENT FOCUS VIEWEVENT
<code>setVisible</code>	<code>public void setVisible(boolean visible)</code>	This value will be stored for the subclass in reference and act. The default value is ValidationRule.NONE.
<code>toString</code>	<code>public String toString()</code>	Set the ViewController's visibility on or off. Remember the state and ask the ViewControllerBaseImpl to handle it. Return the instance class name.

Figure 10A

ViewControllerBaseImpl

Variables

Name	Declaration	Description
copyright	public static final String copyright = "© International Business Machines Inc., 1997 1998 1999. All rights reserved.";	

Figure 10B

Constructors

Name	Declaration	Description
ViewControllerBaseImpl	public ViewControllerBaseImpl()	Default constructor.

Figure 10C

Methods

Name	Declaration	Description
getComponent	public Component getComponent()	By default, return <i>this</i> . This works when the superclass is derived from java.awt.Component. Otherwise, override this method and return your own <i>this</i> , but be sure to override setEnabled and setVisible also.
setEnabled	public void setEnabled(boolean toggle)	By default, passes the call to the super class.
setVisible	public void setVisible(boolean visible)	By default, passes the call to the super class.

Figure 11A

ViewControllerAdapter

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines Inc. 1997-1998-1999. All rights reserved.

Figure 11B

Constructors		
Name	Declaration	Description
ViewControllerAdapter	public ViewControllerAdapter()	Constructor.

Figure 11C

Methods		
Name	Declaration	Description
actionPerformed	public void actionPerformed(ActionEvent e)	Do nothing.
adjustmentValueChanged	public void adjustmentValueChanged(AdjustmentEvent e)	Do nothing.
componentAdded	public void componentAdded(ContainerEvent e)	Do nothing.
componentHidden	public void componentHidden(ComponentEvent e)	Do nothing.
componentMoved	public void componentMoved(ComponentEvent e)	Do nothing.
componentRemoved	public void componentRemoved(ContainerEvent e)	Do nothing.
componentResized	public void componentResized(ComponentEvent e)	Do nothing.
componentShown	public void componentShown(ComponentEvent e)	Do nothing.
focusGained	public void focusGained(FocusEvent e)	Do nothing.
focusLost	public void focusLost(FocusEvent e)	Do nothing.
itemStateChanged	public void itemStateChanged(ItemEvent e)	Do nothing.
keyPressed	public void keyPressed(KeyEvent e)	Do nothing.
keyReleased	public void keyReleased(KeyEvent e)	Do nothing.
keyTyped	public void keyTyped(KeyEvent e)	Do nothing.
mouseClicked	public void mouseClicked(MouseEvent e)	Do nothing.
mouseDragged	public void mouseDragged(MouseEvent e)	Do nothing.
mouseEntered	public void mouseEntered(MouseEvent e)	Do nothing.
mouseExited	public void mouseExited(MouseEvent e)	Do nothing.
mouseMoved	public void mouseMoved(MouseEvent e)	Do nothing.
mousePressed	public void mousePressed(MouseEvent e)	Do nothing.
mouseReleased	public void mouseReleased(MouseEvent e)	Do nothing.
textValueChanged	public void textValueChanged(TextEvent e)	Do nothing.

Figure 12A

ValidationRule
1200

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(C) International Business Machines Inc. 1997 1998 1999. All rights reserved.
NONE	public static final int NONE	
COMPONENT	public static final int COMPONENT	
FOCUS	public static final int FOCUS	
VIEWEVENT	public static final int VIEVENT	

Figure 12B

Constructors
1202

Constructors		
Name	Declaration	Description
ValidationRule	public ValidationRule()	

Figure 12C

Methods
1204

Methods		
Name	Declaration	Description
applyEdits	public static String applyEdits(String classNames, String input) throws ValidationRuleException	Given a list of class names, apply each validation rule of the classes to input string and return the formatted result. Parameters: classNames - a comma-separated fully qualified list of concrete AbstractRule classes. input - the input string to apply edit rules to. Returns: the viewable formatted string. Throws: ValidationRuleException if there was an error in applying the edits.
applyNormalize	public static String applyNormalize(String classNames, String input) throws ValidationRuleException	Given a list of class names, apply each normalize rule of the classes to input string and return the transmittable result. Parameters: classNames - a comma-separated fully qualified list of concrete AbstractRule classes. input - the input string to apply normalize rules to. Returns: the transmittable string. Throws: ValidationRuleException
edit	public abstract String edit(String input) throws ValidationRuleException	Subclasses must implement this method to take an input string and apply some edit rule which returns a properly formatted string that can be used to display to the user. Parameters: input - the input string. Returns: the viewable formatted string. Throws: ValidationRuleException if unable to properly format input string.
normalize	public abstract String normalize(String input) throws ValidationRuleException	Subclasses must implement this method to take an input string and apply some normalize rule which returns a properly formatted string that can be used to send data to some server. Parameters: input - the input string. Returns: the transmittable string. Throws: ValidationRuleException if unable to properly format input string.

Figure 12D

```
/*
 * Given a list of class names, apply each validation rule of the classes
 * to input string and return the formatted result.
 *
 * @return the viewable formatted string.
 * @param classNames a comma-separated fully qualified list of concrete AbstractRule classes.
 * @param input the input string to apply edit rules to.
 * @exception ValidationRuleException if there was an error in applying the edits.
 */
public static String applyEdits(String classNames, String input) throws ValidationRuleException {
    int commaindex = -1;
    int curIndex = 0;
    do {
        commaindex = classNames.indexOf(',');
        curIndex = commaindex + 1;
        if (commaindex == -1) {
            commaindex = classNames.length();
        }
        String className = classNames.substring(commaindex, commaindex).trim();
        try {
            ValidationRule rule = (ValidationRule) Factory.newInstance(className);
            input = rule.edit(input);
        } catch (ValidationRuleException re) {
            throw re;
        } catch (Exception e) {
            throw new ValidationRuleException("Rule class '" + className + "' not found.");
        }
        curIndex = commaindex + 1;
    } while (curIndex < classNames.length());
    return input;
}
```

Figure 13A ValidationRuleException

1300

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.

Figure 13B

1302

Constructors		
Name	Declaration	Description
ValidationRuleException	public ValidationRuleException()	Default constructor.
ValidationRuleException	public ValidationRuleException(String s)	Constructor with a message to the rule exception.

Figure 14A

ViewEvent

1400

Variables	Declaration	Description
_copyright	public static final String _copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.
VIEWEVENT_FIRST	public static final int VIEWEVENT_FIRST	
OK	public static final int OK	
DONE	public static final int DONE	
OPEN	public static final int OPEN	
CLOSE	public static final int CLOSE	
CANCEL	public static final int CANCEL	
EXIT	public static final int EXIT	
FILE	public static final int FILE	
SAVE	public static final int SAVE	
SAVEAS	public static final int SAVEAS	
ERROR	public static final int ERROR	
WARNING	public static final int WARNING	
RETURN	public static final int RETURN	
LOAD	public static final int LOAD	
NOTIFY	public static final int NOTIFY	
NOTIFY2	public static final int NOTIFY2	
INFO	public static final int INFO	
SETUP	public static final int SETUP	
PRINT	public static final int PRINT	

Figure 14B

ViewEvent
(continued)

1400

Variables	Declaration	Description
TITLEMESSAGE	public static final int TITLEMESSAGE	
STATUSMESSAGE	public static final int STATUSMESSAGE	
ERRORMESSAGE	public static final int ERRORMESSAGE	
SUGGESTIONMESSAGE	public static final int SUGGESTIONMESSAGE	
NEXT	public static final int NEXT	
PREVIOUS	public static final int PREVIOUS	
FIRST	public static final int FIRST	
LAST	public static final int LAST	
START	public static final int START	
BEGIN	public static final int BEGIN	
END	public static final int END	
PAUSE	public static final int PAUSE	
STOP	public static final int STOP	
RESTART	public static final int RESTART	
SUBMIT	public static final int SUBMIT	
BACKSPACE	public static final int BACKSPACE	
INSERT	public static final int INSERT	

Figure 14C

ViewEvent
(continued)

1400

Variables	Declaration	Description
HOME	public static final int HOME	
PQUP	public static final int PGUP	
PGDN	public static final int PGDN	
LEFT	public static final int LEFT	
RIGHT	public static final int RIGHT	
UP	public static final int UP	
DOWN	public static final int DOWN	
LIST	public static final int LIST	
MORE	public static final int MORE	
ADD	public static final int ADD	
DELETE	public static final int DELETE	
MODIFY	public static final int MODIFY	
NEW	public static final int NEW	
EDIT	public static final int EDIT	
COPY	public static final int COPY	
CUT	public static final int CUT	
PASTE	public static final int PASTE	
UNDO	public static final int UNDO	
REMOVE	public static final int REMOVE	
PLUS	public static final int PLUS	
MINUS	public static final int MINUS	
INCREMENT	public static final int INCREMENT	
DECREMENT	public static final int DECREMENT	
CHANGED	public static final int CHANGED	

Figure 14D

ViewEvent (continued)

1400

Variables	Name	Declaration	Description
	FILL	public static final int FILL;	
	EMPTY	public static final int EMPTY;	
	READY	public static final int READY;	
	VIEW	public static final int VIEW;	
	DETAILS	public static final int DETAILS;	
	READ	public static final int READ;	
	WRITE	public static final int WRITE;	
	SEARCH	public static final int SEARCH;	
	FIND	public static final int FIND;	
	HELP	public static final int HELP;	
	HINT	public static final int HINT;	
	TRAIN	public static final int TRAIN;	
	TEACH	public static final int TEACH;	
	SUGGEST	public static final int SUGGEST;	
	VIEWEVENTTEST1	public static final int VIEWEVENTTEST1;	
	VIEWEVENTTEST2	public static final int VIEWEVENTTEST2;	
	VIEWEVENTTEST3	public static final int VIEWEVENTTEST3;	
	VIEWEVENT LAST	public static final int VIEWEVENT LAST;	
	consumed	protected boolean consumed;	Is event still valid
	timestamp	protected long timestamp;	Time stamp when event is fired.
	data	protected Object data;	Data reference

Figure 14E

Constructors	Name	Declaration	Description
	ViewEvent	public ViewEvent();	Constructs a ViewEvent
	ViewEvent	public ViewEvent(Object source);	Constructs a ViewEvent
	ViewEvent	public ViewEvent(Object source, int major);	Constructs a ViewEvent object with the specified source object and code;
	ViewEvent	public ViewEvent(Object source, int major, int minor, Object data);	Constructs a ViewEvent object with the specified source object and code;
	ViewEvent	public ViewEvent(Object source, int major, Object data);	Constructs a ViewEvent object with the specified source object and code;

1402

Figure 14F

ViewEvent
(continued)

1404

Methods	Declaration	Description
consume	public final void consume()	Consume this event.
getData	public Object getData()	Return the data
getMajor	public final int getMajor()	Return the major event code
getMinor	public final int getMinor()	Return the event option
getSource	public final Object getSource()	Gets the event source Overrides: getSource in class EventObject
getTimestamp	public long getTimestamp()	Get the timestamp when the event was fired. By default, this was set by JTC.
isConsumed	public final boolean isConsumed()	Is the event consumed?
setConsumed	public final void setConsumed(boolean consumed)	Turn event consumed on/off.
setData	public void setData(Object data)	Sets the data
setMajor	public final void setMajor(int code)	Sets the event code
setMinor	public final void setMinor(int code)	Sets the event option
setSource	public final void setSource(Object source)	Sets the event source
setTimestamp	public void setTimestamp(long time)	Set the timestamp when the event is fired. By default, this is set by JTC.
toString	public String toString()	Returns a string representation of the object. The class of the event and the reason for the event is returned.

Figure 15A

ViewListener
1500

Variables	
Name	Declaration
_copyright	public static final String _copyright

Figure 15B

1502

Methods	
Name	Declaration
viewEventPerformed	public abstract void viewEventPerformed(ViewEvent event)

ApplicationMediator

Copyright © 1997-1999 International Business Machines Corporation. All rights reserved.

Variables

Name	Declaration	Description
copyright	public static final String _copyright	(c) International Business Machines, Inc., 1997 1998 1999. All rights reserved.

FIGURE 16A

1600

Methods

Name	Declaration	Description
addPlacementListener	public abstract void addPlacementListener (PlacementListener listener)	Invoked when a PlacementListener is added.
addRequestListener	public abstract void addRequestListener (RequestListener listener)	
addTopListener	public final void addTopListener (TopListener listener)	Add a TopListener.
addViewListener	public abstract void addViewListener (ViewListener listener)	Invoked when a ViewListener is added.
getPermissions	public abstract String[] getPermissions()	Invoked when the ApplicationMediator permission keys are needed.
init	public abstract void init (ApplicationMediator applicationMediator)	Invoked when an ApplicationMediator should be initialized based on another ApplicationMediator's contents.
isValid	public abstract boolean isValid()	Invoked when the ApplicationMediator's state needs to be checked to see if it is valid.
isVisible	public abstract boolean isVisible()	Invoked to see if the ApplicationMediator is visible.
refresh	public abstract void refresh (Object data)	Invoked to supply new or changed data.
removePlacementListener	public abstract void removePlacementListener (PlacementListener listener)	Invoked to remove a PlacementListener.
removeRequestListener	public abstract void removeRequestListener (RequestListener listener)	Invoked to remove a RequestListener.
removeTopListener	public final void removeTopListener (TopListener listener)	Removes the TopListener.
removeViewListener	public abstract void removeViewListener (ViewListener listener)	Invoked to remove a ViewListener.
setPermissions	public abstract void setPermissions (Hashtable permissions)	Invoked to set the permissions keys and values.
setProperties	public abstract void setProperties (Properties properties)	Invoked to set the properties.
setResources	public abstract void setResources (ResourceBundle bundle)	Invoked to set the resources.
setVisible	public abstract void setVisible (boolean visible)	Invoked to set the visibility.

1602

FIGURE 16B

1600

Figure 17A ApplicationMediatorImpl

1700

Variables	Declaration	Description
placementListeners	protected Vector placementListeners	The PlacementListeners.
topListeners	protected TopListener topListener	The TopListener
requestListeners	protected Vector requestListeners	The RequestListeners.
viewListeners	protected Vector viewListeners	The ViewEventListeners
viewControllers	protected Vector viewControllers	Whenever view controllers are created, it is by convention they will be added to this array.
applicationMediators	protected Vector applicationMediators	Whenever application mediators are created, it is by convention they will be added to this array.
data	protected Object data	This is a reference to the system data model.
requestEvent	protected RequestEvent requestEvent	This is a reference to a RequestEvent.

Figure 17B

1702

Constructors	Declaration	Description
ApplicationMediatorImpl	public ApplicationMediatorImpl()	Constructor. By changing commented code, you can switch between threading styles 1 and 2.

Figure 17C ApplicationMediatorImpl

Methods	Declaration	Description
addPlacementListener	public final void addPlacementListener(PlacementListener listener)	Add a PlacementListener.
addRequestListener	public final void addRequestListener(RequestListener listener)	Add a RequestListener.
addTopListener	public final void addTopListener(TopListener listener)	Add a TopListener.
addViewListener	public final void addViewListener(ViewListener listener)	Add a ViewListener.
clear	public void clear()	
exit	public void exit()	
firePlacementEvent	protected final void firePlacementEvent(PlacementEvent event)	Notify the PlacementListeners.
fireRequestEvent	protected final void fireRequestEvent(RequestEvent event) throws RequestException	Notify the RequestListeners - synchronous
fireRequestEvent	protected final void fireRequestEvent(RequestEvent event, RequestResponseListener caller) throws RequestException	Notify the RequestListeners - asynchronous.
fireTopEvent	protected final void fireTopEvent(TopEvent event)	Notify the TopListeners.
fireTopListener		
fireViewEvent	protected final void fireViewEvent(ViewEvent event)	Notify the ViewListeners.
getAM	protected ApplicationMediator getAM(int i)	Return the i'th ApplicationMediator.
getITCs	public Vector getITCs()	Return a vector of all ThinClient objects. By default, this is a Vector containing the created ViewControllers and ApplicationMediators.
getPermissions	public String[] getPermissions()	Get the sensible permission keys. By default, return the class names of all allocated ViewControllers and ApplicationMediators.
getVC	protected ViewController getVC(int i)	Return the i'th ViewController.
init	public void init()	Initialize the ApplicationMediator, nothing to do by default.
init	public void init(ApplicationMediator applicationMediator)	Initialize the ApplicationMediator using the listeners of an existing ApplicationMediator.
initApplicationMediators	public final void initApplicationMediators(String classnames[]) throws ClassNotFoundException, InstantiationException, IllegalAccessException	For each ApplicationMediator classname, load it, new it and add myself as a ViewEvent. The Factory class is used as a helper class.
initViewControllers	public final void initViewControllers(String classnames[]) throws ClassNotFoundException, InstantiationException, IllegalAccessException	For each ViewController classname, load it, new it and add myself as a ViewEvent. The Factory class is used as a helper class.
isEnabled	public boolean isEnabled()	Is the ApplicationController enabled?
isValid	public boolean isValid()	Return the AND'ed value of calling isValid on ApplicationMediators and ViewControllers.
isVisible	public boolean isVisible()	Is the ApplicationController visible? Hardly, since it is a non visible class. But this looks to see if any of its ViewControllers are visible. Not really, they were all set to visible/invisible via the setVisible method and we remembered the state to return here.
processViewEvent	public abstract void processViewEvent(ViewEvent e)	Deliver the ViewEvent to the subclass via this method.
refresh	public void refresh(Object data)	When new data arrives allow the ViewControllers and ApplicationControllers to be refreshed also.

Figure 17D

ApplicationMediatorImpl
(continued)

1704

Methods

Name	Declaration	Description
removePlacementListener	public final void removePlacementListener(PlacementListener listener)	Removes the PlacementListener.
removeRequestListener	public final void removeRequestListener(RequestListener listener)	Removes the RequestListener.
removeViewListener	public final void removeViewListener(ViewListener listener)	Removes the ViewListener.
requestException	public void requestException(RequestException ex)	Called back because an asynchronous request has thrown an Exception. By default, print the message to System.out.
requestResponse	public void requestResponse(RequestEvent response)	Called back with the results of an asynchronous request. By default, call refresh with the data in the response. This method is used in style 1 threading. Rename this to run() and uncomment the code as described in the class javadoc.
run2	public final void run2()	Set the 5th ApplicationMediator
setAM	public void setAM(ApplicationMediator applicationMediator, int i)	Call setEnabled on each ViewController and ApplicationMediator.
setEnabled	public void setEnabled(boolean toEnable)	Set the permissions. By default, call setPermissions on each ViewController and ApplicationMediator.
setPermissions	public void setPermissions(Hashtable permissions)	Set the properties. By default, call setProperties on each ViewController and ApplicationMediator.
setProperties	public void setProperties(Properties properties)	Set the resources. By default, call setResources on each ViewController and ApplicationMediator.
setResources	public void setResources(ResourceBundle bundle)	Set the i'th ViewController
setVCM	public void setVCM(ViewController viewController, int i)	Set visible on each ViewController and ApplicationMediator.
setVisible	public void setVisible(boolean visible)	Rename the class name of the ApplicationController instance
toString	public String toString()	A ViewEvent is delivered. Process it using Threading style 1 or 2. In the end, the processViewEvent will be called on the subclass.
viewEventPerformed	public void viewEventPerformed(ViewEvent e)	

ApplicationMediatorImpl.exit(): AUS8-1999-0694

```
/*
 * Exit the ApplicationMediator by exiting all allocated ViewControllers
 * and ApplicationMediators. All data is set to null, and lists are
 * destroyed. An 'exited' ApplicationMediator cannot be used again.
 * If this method is overridden in a subclass, be sure to invoke
 * super.exit();
 */

public void exit() {
    synchronized (this) {
        /* Used for style 1 event dispatching. Leave this code commented. */
        //if (this.eventThread != null) {
        //    try {
        //        eventThread.stop();
        //    } catch (Exception e) {
        //    }
        //}

        /* Used for style 2 event dispatching. Leave this code commented. */
        for (int i = 0; i < runningThreads.size(); i++) {
            ((ApplicationMediatorThread) runningThreads.elementAt(i)).stop();
        }

        runningThreads.removeAllElements();
        viewListeners.removeAllElements();
        try {
            for (int i = 0; i < viewControllers.size(); i++) {
                ((ViewController) viewControllers.elementAt(i)).setEnabled(false);
            }
            for (int i = 0; i < applicationMediators.size(); i++) {
                ((ApplicationMediator) applicationMediators.elementAt(i)).exit();
            }
        } catch (Exception noProblem) {
            viewControllers = null;
            applicationMediators = null;
            runningThreads = null;
            runningThreads = null;
            data = null;
        }
    }
}
```

Figure 17E

1706

ApplicationMediatorImpl.clear();AU8-1999-0694

```
/*
 * Clear the ApplicationMediator by clearing all allocated ViewControllers
 * and ApplicationMediators. All data is set to null, but lists are
 * not destroyed. A 'cleared' ApplicationMediator can be used again.
 * If this method is overridden in a subclass, be sure to invoke
 * super.clear();
 */

public void clear() {
    synchronized (this) {
        /* Used for style 1 event dispatching. Leave this code commented. */
        //if (this.eventThread != null) {
        //    try {
        //        eventThread.stop();
        //    } catch (Exception e) {
        //    }
        //}

        /* Used for style 2 event dispatching. Leave this code commented. */
        for (int i = 0; i < runningThreads.size(); i++) {
            ((ApplicationMediatorThread) runningThreads.elementAt(i)).stop();
        }
        runningThreads.removeAllElements();

        //try {
        //    for (int i = 0; i < viewControllers.size(); i++) {
        //        ((ViewController) viewControllers.elementAt(i)).setEnabled(false);
        //    }
        //    for (int i = 0; i < applicationMediators.size(); i++) {
        //        ((ApplicationMediator) applicationMediators.elementAt(i)).clear();
        //    }
        //} catch (Exception noRealProblemo) {
        //    viewControllers = null;
        //    applicationMediators = null;
        //    data = null;
        //    viewListeners.removeAllElements();
        //}
    }
}
```

1708

Figure 17F

```
/*
 * Initialize the ApplicationMediator using the listeners of an
 * existing ApplicationMediator.
 */
public void init(ApplicationMediator applicationMediator) {
    if (applicationMediator instanceof ApplicationMediatorImpl) {
        ApplicationMediatorImpl a = (ApplicationMediatorImpl) applicationMediator;
        requestListeners = (Vector) a.requestListeners.clone();
        placementListeners = (Vector) a.placementListeners.clone();
        topListeners = (Vector) a.topListeners.clone();
        addViewListener(a);
    }
    init();
}
```

1710

Figure 17G

Figure 17H

```
/*
 * When new data arrives allow the ViewControllers
 * and ApplicationControllers to be refreshed also.
 */
public void refresh(Object data) {
    this.data = data;
    try {
        synchronized (viewControllers) {
            for (int j = 0; j < viewControllers.size(); j++) {
                ((ViewController) viewControllers.elementAt(j)).
                    refresh(data);
            }
        }
        catch (Exception noRealProblem) {
        }
    }
    try {
        synchronized (applicationMediators) {
            for (int j = 0; j < applicationMediators.size(); j++) {
                ((ApplicationMediator) applicationMediators.
                    elementAt(j)).refresh(data);
            }
        }
        catch (Exception noRealProblem) {
        }
    }
}
```

```

    /**
     * A ViewEvent is delivered. Process it using Threading style 1 or 2. In
     * the end, the processViewEvent will be called on the subclass.
     */
    public void viewEventPerformed(ViewEvent e) {
        /* Used for style 2 event dispatching, start an inner class thread */
        ApplicationMediatorThread t = new ApplicationMediatorThread(e);
        runningThreads.addElement(t);
        t.start();
    }

    /* Used for style 1 event dispatching. Leave this code commented. */
    //ViewEvent saved = saveViewEvent(e);
    //if (eventThread == null || !eventThread.isAlive()) {
    //    finished = false;
    //    eventThread = new Thread(this);
    //    eventThread.start();
    //}
    //synchronized (this) {
    //    notify();
    //}
}


```

1714

Figure 171

```
/*
 * This method is used in style 1 threading. Rename this to run()
 * and uncomment the code as described in the class javadoc.
 */
public final void run2() {
    /* Used for style 1 event dispatching. Leave this code commented. */
    /*
    while (true) {
        ViewEvent event = null;
        event = getViewEvent();
        if (event != null) {
            handleViewEvent(event);
        } else {
            waitForEvent();
            if (finished) {
                //something went wrong with the thread so hose this loop
                break;
            }
        }
    }
}
```

Figure 17J

```
/*
 * Private class to handle executions of ViewEvents() on another thread.
 */
private class ApplicationMediatorThread extends Thread {
    /**
     * The current event
     */
    private ViewEvent event;
    /**
     * Create an ApplicationMediatorThread to process the ViewEvent
     */
    public ApplicationMediatorThread(ViewEvent event) {
        super();
        this.event = event;
    }
    /**
     * Just call the handleViewEvent method that the subclass will override
     */
    public void run() {
        processViewEvent(event);
    }
}
```

Figure 17K

1714

```
/*
 * Save the current ViewEvent on a Q
 */
private final ViewEvent saveViewEvent(ViewEvent e) {
    /* Used for style 1 event dispatching. Leave this code commented. */
    //return viewEventQueue.add(e);
    return null;
}

1714

/*
 * Method: return the first view event saved. Used by the Q'ing system.
 */
private ViewEvent getViewEvent() {
    /* Used for style 1 event dispatching. Leave this code commented. */
    //return (ViewEvent) viewEventQueue.remove();
    return null;
}
```

Figure 17L

Figure 18A

1800 PlacementEvent

Variables	Declaration	Description
_copyright	public static final String _copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.
PLACEMENTEVENT_FIRST	public static final int PLACEMENTEVENT_FIRST	
ADD	public static final int ADD	
REMOVE	public static final int REMOVE	
MODIFY	public static final int MODIFY	
PLACEMENTEVENT_LAST	public static final int PLACEMENTEVENT_LAST	
major	protected int major	The placementevent code
minor	protected int minor	the placementevent option
component	protected Object component	Component Reference
data	protected Object data	Data Reference

Figure 18B

1802

Constructors	Declaration	Description
PlacementEvent	public PlacementEvent()	Constructs a PlacementEvent
PlacementEvent	public PlacementEvent(Object source, Object component)	Constructs a PlacementEvent
PlacementEvent	public PlacementEvent(Object source, Object component, int major)	Constructs a PlacementEvent
PlacementEvent	public PlacementEvent(Object source, Object component, int major, int minor)	Constructs a PlacementEvent
PlacementEvent	public PlacementEvent(Object source, Object component, int major, int minor, Object data)	Constructs a PlacementEvent

Figure 18C

1804

Methods	Declaration	Description
getComponent	public final Component getComponent()	Return the Component
getData	public final Object getData()	Return the data
getMajor	public final int getMajor()	Return the major code
getMinor	public final int getMinor()	Return the minor code
getSource	public final Object getSource()	Gets the event source
setComponent	public final void setComponent(Component component)	Sets the Component
setData	public final void setData(Object data)	Set the data
setMajor	public final void setMajor(int code)	Set the major code
setMinor	public final void setMinor(int code)	Set the minor code
setSource	public final void setSource(Object source)	Set the event source
toString	public String toString()	Returns a string representation of the object.

PlacementListener

1900

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines, Inc. 1997 1998 1999. All rights reserved.

FIGURE 19A

FIGURE 19B

1902

Methods		
Name	Declaration	Description
placementEventPerformed	public abstract void placementEventPerformed (PlacementEvent event)	Invoked when we are being called to add/remove/modify a component. Do it.

TopEvent

2000

FIGURE 20A

Variables

Name	Declaration	Description
copyright	public static final String copyright	
TOEVENT_FIRST	public static final int TOEVENT_FIRST	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.
EXIT	public static final int EXIT	
ROWSER	public static final int BROWSER	
TITLE	public static final int TITLE	
STATUS	public static final int STATUS	
OS	public static final int OS	
A	public static final int A	
B	public static final int B	
C	public static final int C	
D	public static final int D	
E	public static final int E	
F	public static final int F	
TRACE	public static final int TRACE	
DEBUG	public static final int DEBUG	
LOG	public static final int LOG	
HOOKAWT	public static final int HOOKAWT	
HOOKJTC	public static final int HOOKJTC	
TOEVENT_LAST	public static final int TOEVENT_LAST	
TEAM	public static final int TEAM	
WIN	public static final int WIN	
EXECUTE	public static final int execute	
consumed	protected boolean consumed	Is event still valid?
data	protected Object data	This is a loose reference to the data model. We don't care what the class shape is and we only reference it via the interface that it must implement.

TopEvent

FIGURE 20B

2002

Constructors		
Name	Declaration	Description
TopEvent()	public TopEvent()	Default constructor for a Request.
TopEvent(Object)	public TopEvent (Object source)	Construct with the given source and default major and minor values.
TopEvent(Object, int)	public TopEvent (Object source, int major)	Create a Request with a source, major and minor codes.
TopEvent(Object, int, int)	public TopEvent (Object source, int major, int minor)	Create a Request with major and minor codes.
TopEvent(Object, int, int, Object)	public TopEvent (Object source, int major, int minor, Object data)	Create a Request with a source, major and minor codes, and some data. If source is null, an InvalidArgumentException will be thrown.

FIGURE 20C

2004

Methods		
Name	Declaration	Description
consume	public final void consume ()	Consume this event
getData	public final Object getData ()	Return the reference to the data.
getMajor	public final int getMajor ()	Get the major code.
getMinor	public final int getMinor ()	Get the minor code.
getSource	public final Object getSource ()	Gets the event source. Overrides: getSource in class EventObject
isConsumed	public final boolean isConsumed ()	Is the event consumed?
setConsumed	public final void setConsumed (boolean consumed)	Turn event consumed on or off.
setData	public final void setData (Object data)	Set the data.
setMajor	public final void setMajor (int major)	Set the major code.
setMinor	public final void setMinor (int minor)	Set the minor code. This is always a String.
setSource	public final void setSource (Object source)	Set the event source.
toString	public String toString ()	Show a String representation of the Request in the format of "TopEvent(major,minor)"

TopListener

FIGURE 21A

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines, Inc., 1997 1998 1999. All rights reserved.

FIGURE 21B

Methods		
Name	Declaration	Description
exec	public abstract void exec (Object programInformation)	Invoked to execute a desktop program. The parameter programInformation can be a complex object with lots of data. For example: String[] params = {"netscape.exe", "http://www.ibm.com"}; a TopListener.exec(params). Another usage might be to interact with JavaScript under a browser. It is up to the TopListener implementer to understand what the params mean. Do not create a language with a language. This method should only be defined to support legacy environments or corporate desktop rules. Consider using a RequestEvent for more complex requirements.
exit	public abstract void exit()	Invoked to exit a JTC application. Never let a program perform its own "exit". This shifts the "TM down. The implementer of TopListener will know the appropriate actions to take to exit from an application on a corporate desktop.
message	public abstract void message (Object messageInfo)	Invoked to show a business specific message. Try to isolate calls to the browser here.
title	public abstract void title (Object titleInfo)	Invoked to display a business specific title. Try to isolate calls to a browser or a desktop program to display titles here.
topEventPerformed	public abstract void topEventPerformed (TopEvent event)	Invoked when we are being called to perform a top desktop function.

Figure 22A

RequestEvent
2200

Variables	
Name	Declaration
copyright	public static final String copyright
consumed	protected boolean consumed
data	protected Object data

Figure 22B

2202

Constructors	
Name	Declaration
RequestEvent	public RequestEvent()
RequestEvent	public RequestEvent(Object source)
RequestEvent	public RequestEvent(Object source, String major)
RequestEvent	public RequestEvent(Object source, String major, String minor)
RequestEvent	public RequestEvent(Object source, String majorCode, String minorCode, Object data)

Figure 22C

2204

Methods	
Name	Declaration
consume	public final void consume()
getData	public final Object getData()
getMajor	public final String getMajor()
getMinor	public final String getMinor()
getSource	public final Object getSource()
getStatus	public final String getStatus()
isConsumed	public final boolean isConsumed()
setConsumed	public final void setConsumed(boolean consumed)
setData	public final void setData(Object data)
setMajor	public final void setMajor(String major)
setMinor	public final void setMinor(String minor)
setSource	public final void setSource(Object source)
setStatus	public final void setStatus(String message)
toString	public String toString()

Figure 23A

RequestException

2300

Variables	
Name	Declaration
copyright	public static final String copyright

Figure 23B

2302

Constructors	
Name	Declaration
RequestException	Public RequestException()
RequestException	Public RequestException(String s)
RequestException	Public RequestException(Throwable target)
RequestException	Public RequestException(Throwable target, String s)

Figure 23C

2304

Methods	
Name	Declaration
getTargetException	public Throwable getTargetException()
setTargetException	public void setTargetException(Throwable target)
toString	public String toString()

RequestListener

FIGURE 24A

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines, Inc., 1997 1998 1999. All rights reserved.

FIGURE 24B

Methods		
Name	Declaration	Description
requestEventPerformed	public abstract void requestEventPerformed (RequestEvent request) throws RequestException	Invoked for a synchronous RequestEvent.
requestEventPerformed	public abstract void requestEventPerformed (RequestEvent request, RequestResponseListener listener) throws RequestException	Invoked for an asynchronous RequestEvent

RequestResponseListener

FIGURE 25A

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(C) International Business Machines, Inc., 1997 1998 1999. All rights reserved.

FIGURE 25B

Methods		
Name	Declaration	Description
requestException	public abstract void requestException (RequestException yikes)	Invoked when an exception occurred during processing of an asynchronous RequestEvent.
requestResponse	public abstract void requestResponse (RequestEvent result)	Invoked when the processing of an asynchronous RequestEvent was successful.

Figure 26A

Transporter

2600

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.
PRIORITY	public static final String PRIORITY	Priority symbol
WILDCARD	public static final String WILDCARD	Wildcard symbol

Figure 26B

2602

Constructors		
Name	Declaration	Description
Transporter	public Transporter()	Default constructor.

Figure 26C

Transporter 2604

Methods	Name	Declaration	Description
	<code>addDestinationListener</code>	<code>public void addDestinationListener(Object major, Destination destination)</code>	Add the Destination using the given major code. If the destination is present with the same major don't re-add it - only one major/destination pair can exist. If the major is present, but the destination isn't, add the destination to the list of other destinations with the same key. If the key isn't present, store it and then add the new destination. If the destination is disabled, do nothing.
	<code>clear</code>	<code>public void clear()</code>	For each RequestEvent not started, a RequestException will be thrown and the internal data structures will be emptied including RequestEvent queues and listeners.
	<code>exit</code>	<code>public void exit()</code>	For each RequestEvent not started, a RequestException will be thrown and the internal data structures will be emptied including RequestEvent queues and listeners. All variable references will be set to null.
	<code>getDestinations</code>	<code>public synchronized Vector<Destination> getDestinations()</code>	Return a Vector of all Destinations currently registered.
	<code>getDestinations</code>	<code>public Vector<Destination> getDestinations(Object major)</code>	Return a Vector of the Destinations currently registered for the given major code.
	<code>getTCs</code>	<code>public Vector<TC> getTCs()</code>	Return allocated TC objects. By default, return the Destinations.
	<code>getMajorCodes</code>	<code>public Vector<MajorCode> getMajorCodes()</code>	Return a Vector of the registered major codes.
	<code>init</code>	<code>public void init()</code>	Initialize the transporter. By default, do nothing.
	<code>isEnabled</code>	<code>public boolean isEnabled()</code>	Is this Transporter enabled or disabled? A Transporter that is disabled will not process an RequestEvents but will throw RequestExceptions.
	<code>isTagging</code>	<code>public boolean isTagging()</code>	Is this Transporter tagging RequestEvents?
	<code>processDestinations</code>	<code>protected void processDestinations(RequestEvent request, Vector<currentDestination>) throws RequestException</code>	Given a RequestEvent and a Vector of destinations, call each Destination in FIFO/FEFR order. If tagging is enabled, then append a status tag to the RequestEvent.
	<code>removeDestinationListener</code>	<code>public void removeDestinationListener(Object major, Destination d)</code>	Remove the destination using the given major. If the destination is not present, do nothing. If the destination is present, just remove it. If it was the last destination, remove all references to the major code.
	<code>requestEventPerformed</code>	<code>public void requestEventPerformed(RequestEvent request) throws RequestException</code>	Submit a synchronous request. For each Destination that is listening for the current family of RequestEvents (the major code), send the RequestEvent to the Destination for processing. If there is a problem, throw a RequestException. Continue processing the RequestEvent as long as a RequestException is not thrown by a Destination and the RequestEvent is not consumed. If tagging is enabled, then append a status tag to the RequestEvent. Destinations are process in the following FIFO order: 1- All using ":" (priority). 2- All using a major code. 3- All using "..."
	<code>requestEventPerformed</code>	<code>public void requestEventPerformed(RequestEvent request, RequestResponseListener caller) throws RequestException</code>	Submit an asynchronous request. See the synchronous requestEventPerformed for more information.
	<code>setEnabled</code>	<code>public void setEnabled(boolean toggle)</code>	Enabled or disable the Transporter. A disabled Transporter will throw RequestExceptions if accessed via requestEventPerformed.
	<code>setRequestListener</code>	<code>public void setRequestListener(boolean toggle)</code>	Stop or start the tagging of RequestEvents.
	<code>toString</code>	<code>public String toString()</code>	Return the String Transporter plus the number of registered Destinations.

Transporter.processDestinations(RequestEvent, Vector) AUS8-1999-0693

```
/*
 * Given a RequestEvent and a Vector of destinations, call each Destination
 * in FIFO/FEFR order.
 * <p>
 * If tagging is enabled, then append a status tag to the RequestEvent.
 * @exception RequestException if the Request can't be submitted
 */
protected void processDestinations(RequestEvent request, Vector currentDestinations) throws RequestException {
    if (!enabled) {
        throw new RequestException("Transporter disabled");
    }
    if (currentDestinations == null)
        return;
    /*
     * process FIFO/FEFR */
    Destination d = null;
    int size = currentDestinations.size();
    for (int i = 0; !request.isConsumed() && i < size; i++) {
        d = (Destination) currentDestinations.elementAt(i);
        d.requestEventPerformed(request);
        /* Try to tag the request */
        if (tagging)
            request.setStatus(request.getStatus() + d);
    }
}
```

Figure 26D

```

Transporter.requestEventPerformed(RequestEvent)AUSB-1999-0693

/**
 * Submit a synchronous request. For each Destination that is listening for
 * the current family of RequestEvents (the major code), send the RequestEvent
 * to the Destination for processing. If there is a problem, throw
 * a RequestException. Continue processing the RequestEvent as long
 * as a RequestException is not thrown by a Destination and the RequestEvent
 * is not consumed.
 * <p>
 * <p>
 * If tagging is enabled, then append a status tag to the RequestEvent.
 * <p>
 * Destinations are process in the following FIFO order:
 *   * 1- All using "!" (priority).
 *   * 2- All using a major code.
 *   * 3- All using "*".
 * <p>
 * @exception RequestException if the Request can't be submitted
 */

public void requestEventPerformed(RequestEvent request) throws RequestException {
    if (!enabled) {
        throw new RequestException("Transporter disabled");
    }

    /* Try to tag the request */
    if (tagging)
        request.setStatus(request.getStatus() + "[Transporter]");
}

/* Process PRIORITY, major and then WILDCARD destinations */
processDestinations(request, getDestinations(PRIORITY));
processDestinations(request, getDestinations(request.getMajor()));
processDestinations(request, getDestinations(WILDCARD));
}

```

Figure 26E

2608

```
/*
 * Submit an asynchronous request. See the synchronous
 * requestEventPerformed for more information.
 */
public void requestEventPerformed(RequestEvent request,
RequestResponseListener caller) throws RequestException {
if (!enabled) {
    throw new RequestException("Transporter disabled");
}
if (tagging)
    request.setStatus(request.getStatus() +
        "TTransporter async.");
}

//start an inner classs thread
TransporterThread t = new TransporterThread(request, caller);
runningThreads.put(request, t);
t.start();
}
```

Figure 26F

Transporter.TransporterThread:AUS8-1999-0693

```
/*
 * Private class to handle executions of submits() on another
thread.
 */
private class TransporterThread extends Thread {
    /**
     * The current request
     */
    private RequestEvent request;
    /**
     * The caller of submit that we will call back
     */
    private RequestResponseListener caller;
    /**
     * Create a transporter thread
     */
    public TransporterThread(RequestEvent request,
RequestResponseListener caller) {
        super();
        this.request = request;
        this.caller = caller;
    }
    /**
     * Just call the synchronous version of
requestEventPerformed()
     */
    public void run() {
        try {
            requestEventPerformed(request);
            caller.requestResponse(request);
        } catch (RequestException yikes) {
            caller.requestException(yikes);
        } finally {
            runningThreads.remove(request);
        }
    }
}
```

2610
Figure 26G

Destination

Figure 27A

2700

Variables		
Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines Inc. 1997-1998-1999. All rights reserved.

Figure 27B

2702

Methods	
Name	Declaration
getTimeout	public abstract long getTimeout()
requestEventPerformed	public abstract void requestEventPerformed (RequestEvent request) throws RequestException
setTimeout	public abstract void setTimeout(long timeout)

Figure 28A

DestinationImpl

Variables

Name	Declaration	Description
copyright	public static final String copyright	(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.

Figure 28B

Constructors

Name	Declaration	Description
DestinationImpl	public DestinationImpl()	Default constructor.

Figure 28C

Methods

Name	Declaration	Description
clear	public void clear()	By default, do nothing.
exit	public void exit()	By default, do nothing.
getJTCs	public Vector getJTCs()	By default, do nothing.
getTimeout	public long getTimeout()	Return the timeout value.
init	public void init()	By default, do nothing.
isEnabled	public boolean isEnabled()	Is the Destination enabled?
requestEventPerformed	public void requestEventPerformed(RequestEvent request) throws RequestException	A RequestEvent has arrived. If not enabled, throw and exception. Subclasses can call this method first to see if processing should continue.
setEnabled	public void setEnabled(boolean enable)	Enable or disable the Destination. A Destination that is called when disable will throw a RequestException. By default, record it.
setTimeout	public void setTimeout(long timeout)	Set the timeout value. By default, record it.
toString	public String toString()	Returns a String that represents the value of this object which is the class name and the timeout value.

RemoteDestination.requestEventPerformed(RequestEvent) AUS8-1999-0704

```
/*
 * Process request event.
 * <P>PRE: None
 * <P>POST: None
 *
 * @param request the RequestEvent object to be processed.
 * @exception RequestException if there was an error during the
 * processing of the event.
 */
public void requestEventPerformed(RequestEvent request) throws
RequestException {
    try {
        Method method = null;
        if (session == null) {
            // get home interface.
            Context ctxt = getInitialContext ();
            Object home = ctxt.lookup(request.getMajor () +
"SessionHome");
            method = home.getClass () .getMethod ("create", null);
            session = method.invoke (home, null);
        }

        // get method on home object and invoke it.
        method = session.getClass () .getMethod (request.getMinor (), 
new Class [] {Object.class});
        request.setData (method.invoke (session, new Object []
{request.getData () }));
        if (request.getMinor () .equals ("remove")) {
            session = null;
        }
    } catch (InvocationTargetException te) {
        throw new RequestException (te.getTargetException ());
    } catch (Throwable t) {
        throw new RequestException (t);
    }
}
```

Figure 28D

Figure 29A

Factory

Variables	
Name	Declaration
copyright	public static final String copyright

(c) International Business Machines Inc., 1997 1998 1999. All rights reserved.

Figure 29B

Methods	
Name	Declaration
list	public static void list()
newInstance	public static Object newInstance(String classname, String key, boolean singleton) throws ClassNotFoundException, InstantiationException, IllegalAccessException
newInstance	public static Object newInstance(String classname, boolean singleton) throws ClassNotFoundException, InstantiationException, IllegalAccessException
newInstance	public static Object newInstance(String classname, boolean singleton) throws ClassNotFoundException, InstantiationException, IllegalAccessException
newInstance	public static Vector newInstance(String classnames[]) throws ClassNotFoundException, InstantiationException, IllegalAccessException
newInstance	public static Vector newInstance(String classnames[], String keys[], boolean singleton) throws ClassNotFoundException, InstantiationException, IllegalAccessException
newInstance	public static Vector newInstance(String classnames[], String keys[], boolean singleton) throws ClassNotFoundException, InstantiationException, IllegalAccessException
removeInstance	public static void removeInstance(String key) throws ClassNotFoundException, InstantiationException, IllegalAccessException
removeInstances	public static void removeInstances(String keys[]) throws ClassNotFoundException, InstantiationException, IllegalAccessException

2900

2902

Given some class names, create and return a Vector of objects. If you want singleton objects system wide, then if any of the classes were already created, return them, otherwise, create the new ones, remember them and return them. The class names are not used as the keys but the "keys" parameter are.

Given some class names, create and return a Vector of objects. If you want singleton objects system wide, then if any of the classes were already created, return them, otherwise, create the new ones, remember them and return them. Use the class name as the key

Given some class names, clear the reference to it.

Given some class keys, clear the references.

Interface com.ibm.jtc.JTC

FIGURE 30A

3000

Variables		
Name	Declaration	Description
<code>_copyright</code>	Public static final String <code>_copyright</code>	International Business Machines Inc., 19997 1998 1999. All rights reserved.
<code>_version</code>	Public static final String <code>version</code>	
<code>_author</code>	Public static final String <code>_author</code>	
<code>_email</code>	Public static final String <code>_email</code>	

FIGURE 30B

3002

Methods		
Name	Declaration	Description
<code>clear</code>	Public abstract void <code>clear()</code>	Invoked to indicate that all memory allocations should be cleaned up. This includes removing listeners and flushing any lists (vectors or hashables). A JTC object that has been cleared can be reused.
<code>exit</code>	public abstract void <code>exit()</code>	Invoked to indicate that all memory allocations should be cleaned up. This includes removing listeners and flushing any lists (vectors or hashables). It also includes setting all variable references to null. A JTC object that has been cleared cannot be reused.
<code>getJTCs</code>	Public abstract Vector <code>getJTCs()</code>	Invoked to get a Vector of all JTC objects that this JTC object has created. For example, a Transporter will at least return all of its Destinations. This is a very powerful mechanism. It allows us to get a reference to all primary objects in the JTC application and manipulate them according to the JTC methods, or by casting them to more specific classes or interfaces and manipulating them. Examples usage includes non code intrusive tracing, debugging, logging, profiling, etc.
<code>init</code>	Public abstract void <code>init()</code>	Invoked to initialize the JTC object. The object should be ready for operation.
<code>isEnabled</code>	Public abstract boolean <code>isEnabled()</code>	Invoked to determine if the JTC object is enabled.
<code>setEnabled</code>	Public abstract void <code>setEnabled(boolean enable)</code>	Invoked to enable or disable the JTC object.
<code>toString</code>	Public abstract String <code>toString()</code>	Invoked to get a String representation of the JTC object.

Figure 31

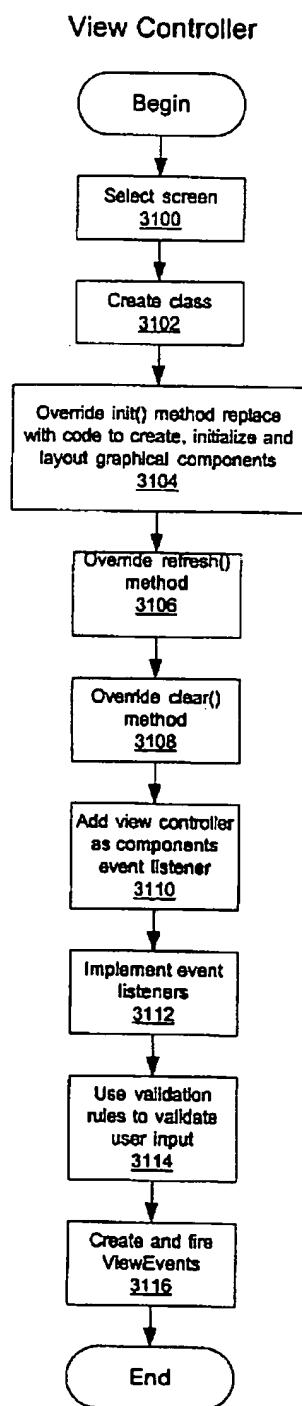


Figure 32

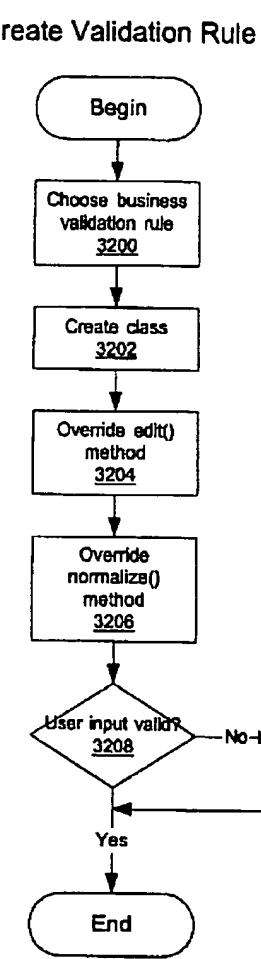


Figure 33

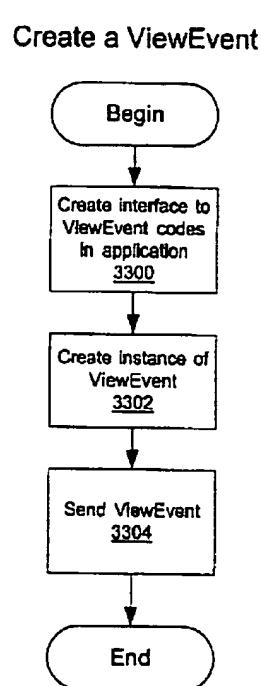


Figure 34

Create ApplicationMediator

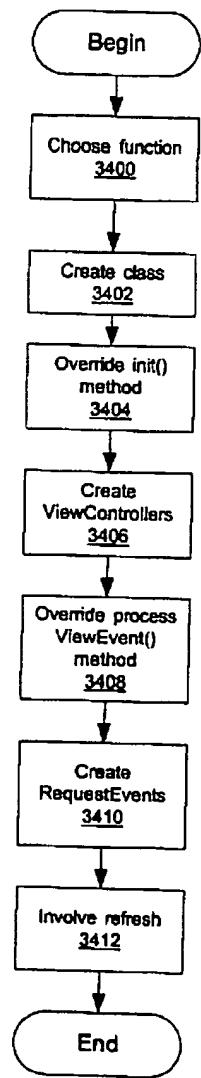


Figure 35

Create RequestEvent

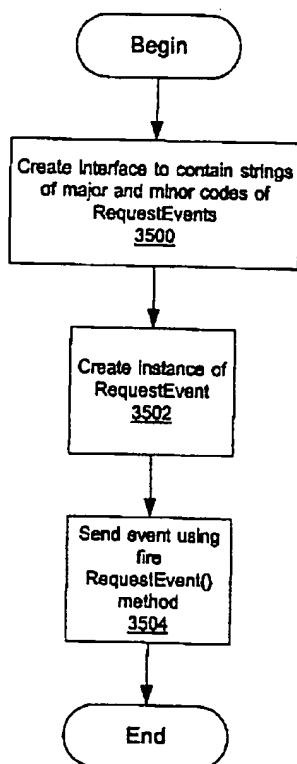


Figure 36

Create a Destination

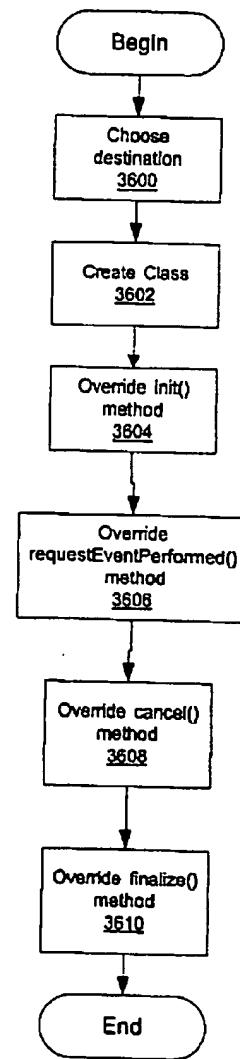


Figure 37

Create TopListener

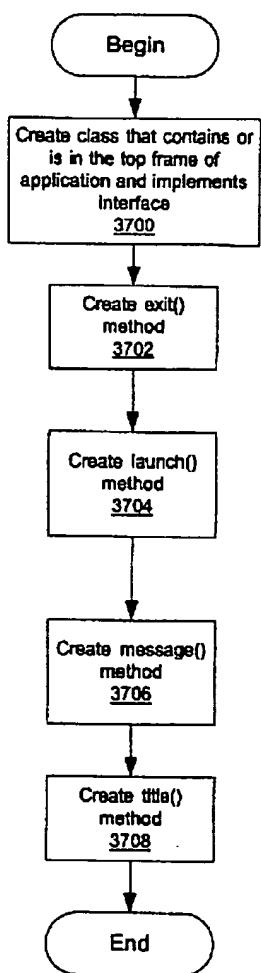
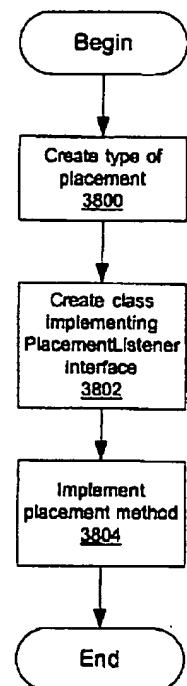


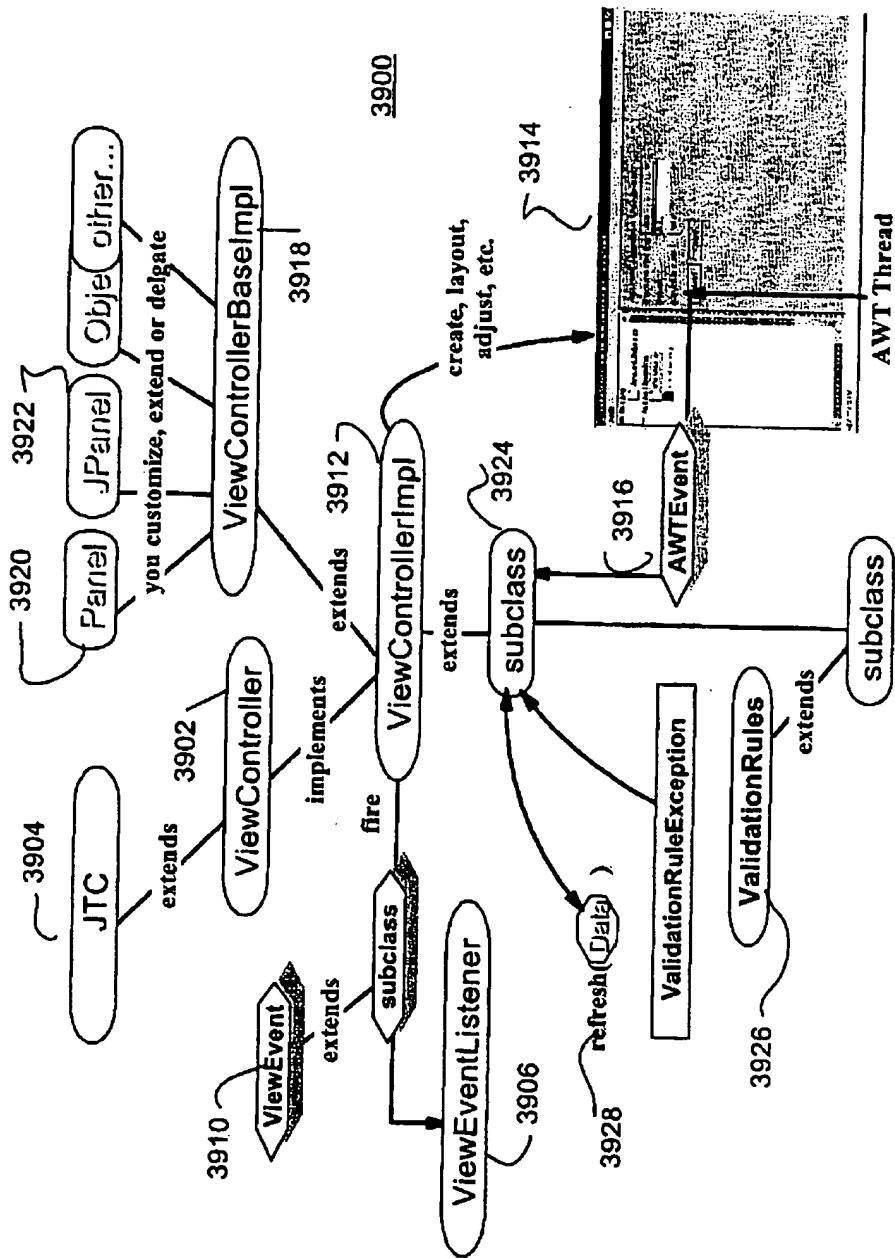
Figure 38

Create PlacementListener



ViewController runtime

Figure 39



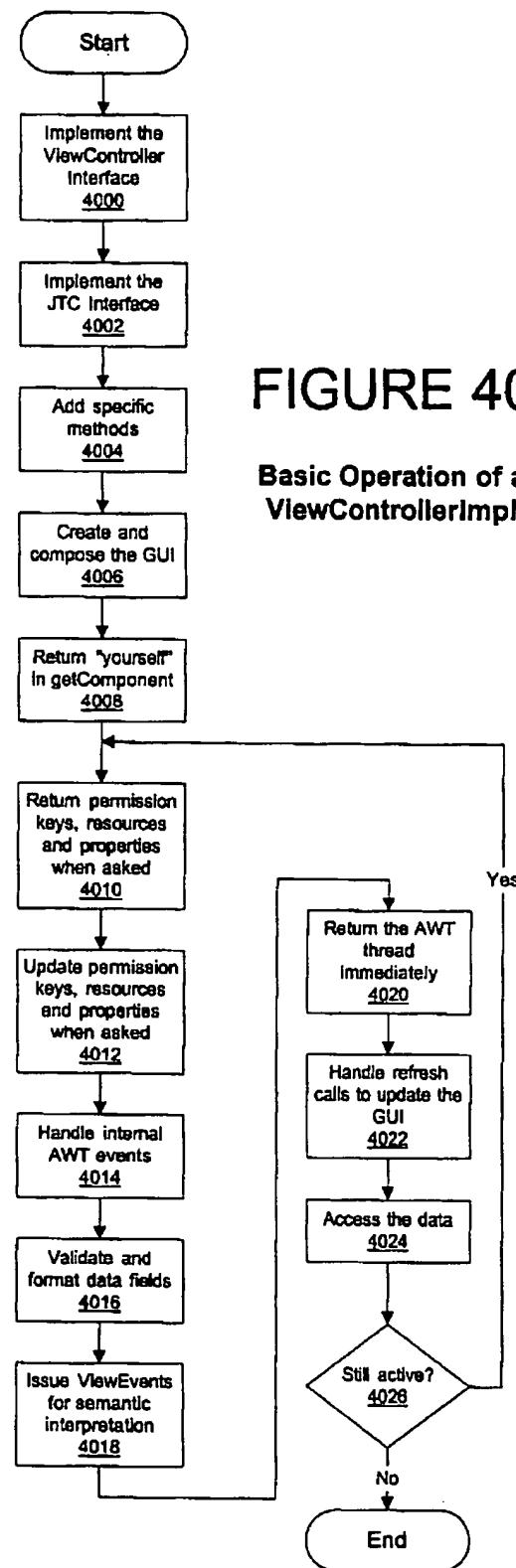
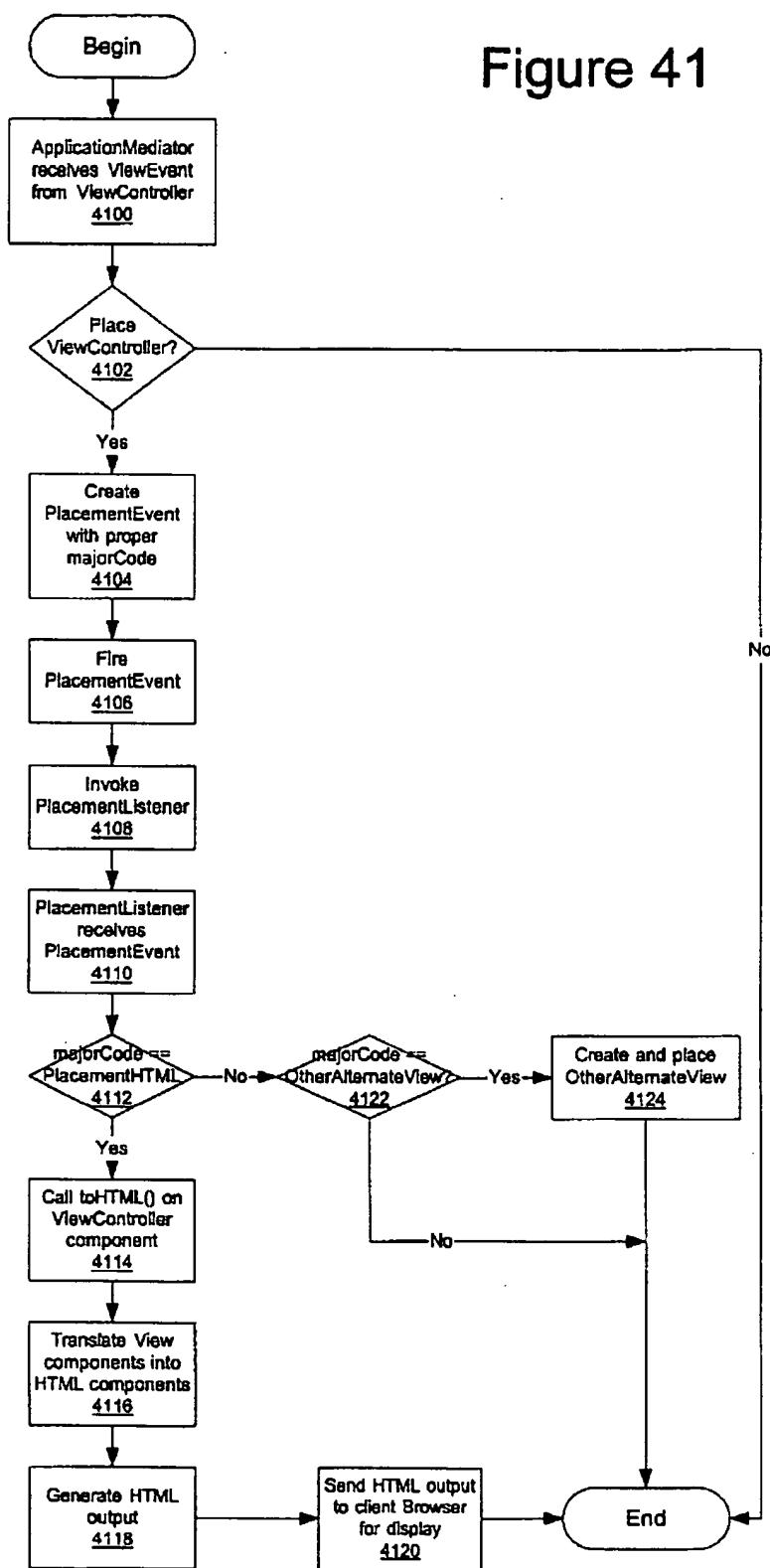


FIGURE 40

Basic Operation of a ViewControllerImpl

Figure 41



ViewEvent and ViewListener Usage

FIGURE 42

```
→ Usage from a ViewController
public void actionPerformed(ActionEvent e) {
    if (e.getSource() == nextButton) {
        ViewEvent ve = new ViewEvent(this);
        ve.setMajor(ViewEvent.NEXT);
        fireViewEvent(ve); // notify
        ViewEventListener r;
        return;
    }
}
```

FIGURE 43

```
→ Usage from ViewListener (i.e. ApplicationMediator)
// add myself as a listener
customerDetailsViewController.addViewListener(this);

// later, we are called back on this method to handle the
ViewEvent
processViewEvent(ViewEvent event) {
    // do something
    switch (event.getMajor()) {
        case ViewEvent.NEXT: //...
            break;
        case ViewEvent.OK: //...
            break;
    }
}
```

Major and/or minor codes

FIGURE 44

► Pre-defined major codes- A subclass can define others.

- // system
 - OK DONE OPEN CLOSE CANCEL EXIT FILE SAVE SAVEAS ERROR WARNING RETURN LOAD NOTIFY NOTIFY2 INFO SETUP PRINT LOGIN LOGOUT ENABLE DISABLE
- // status
 - TITLEMESSAGE STATUSMESSAGE ERRORMESSAGE SUGGESTIONMESSAGE
- // navigational
 - NEXT PREVIOUS FIRST LAST START BEGIN END PAUSE STOP RESTART SUBMIT BACKSPACE INSERT HOME PGUP PGDN LEFT RIGHT UP DOWN
- // live
 - FAST MEDIUM SLOW RUN DELAY WAIT TIMER ON OFF HIGH LOW
- // data related
 - LIST MORE ADD DELETE MODIFY NEW EDIT COPY CUT PASTE UNDO REMOVE PLUS MINUS INCREMENT DECREMENT CHANGED FILL EMPTY READY VIEW DETAILS READ WRITE UPDATE REFRESH
- // assist related
 - SEARCH FIND HELP HINT TRAIN TEACH SUGGEST
- // sub options related
 - A B C D E F OPTION CHOOSE
- // test values
 - TRACE UNTRACE DEBUG UNDEBUG LOG UNLOG HOOK UNHOOK
- // Ibm values
 - TEAM WIN EXECUTE

ValidationRules Usage

- Examples:

```
edit("123456")      -> $1234.56
normalize("1234.56") -> 123456
edit("12345x")      -> ValidationRuleException
```
- edit
 - //validate and re-display
 - string value = textField.getText();
 - try {
 - result = SocialSecurity.edit(value);
 - }
 - catch (ValidationRuleException yikes) {
 - //...
 return;
 - }
 - textField.setText(value);
- normalize
 - //validate and update the data objects
 - string value = textField.getText();
 - try {
 - result = SocialSecurity.normalize(value);
 - }
 - catch (ValidationRuleException yikes) {
 - //message box ...
 return;
 - }
 - dataObject.setText(value);

FIGURE 45

FIGURE 46

ValidationRules Usage

→ Example Chaining

```
//each rule
String range = "com.xyz.jtc.RangeChecker";
String money = "com.xyz.jtc.AccountMoney";

//build the chain of rules
String[] rules = {range, money};

//get the value to validate
String value = textField.getText();

try {
    value = applyEdits(rules, input);
}
catch (ValidationRuleException ouch) {
    //...
}

//the value is validated and formatted, redisplay
textField.setText(value);
```

FIGURE 47

View Controller BaseImpl

- For example:
 - Inheritance

```
public class ViewControllerBaseImpl extends JPanel {  
    public Component getComponent() {  
        return this;  
    }  
}
```

FIGURE 48

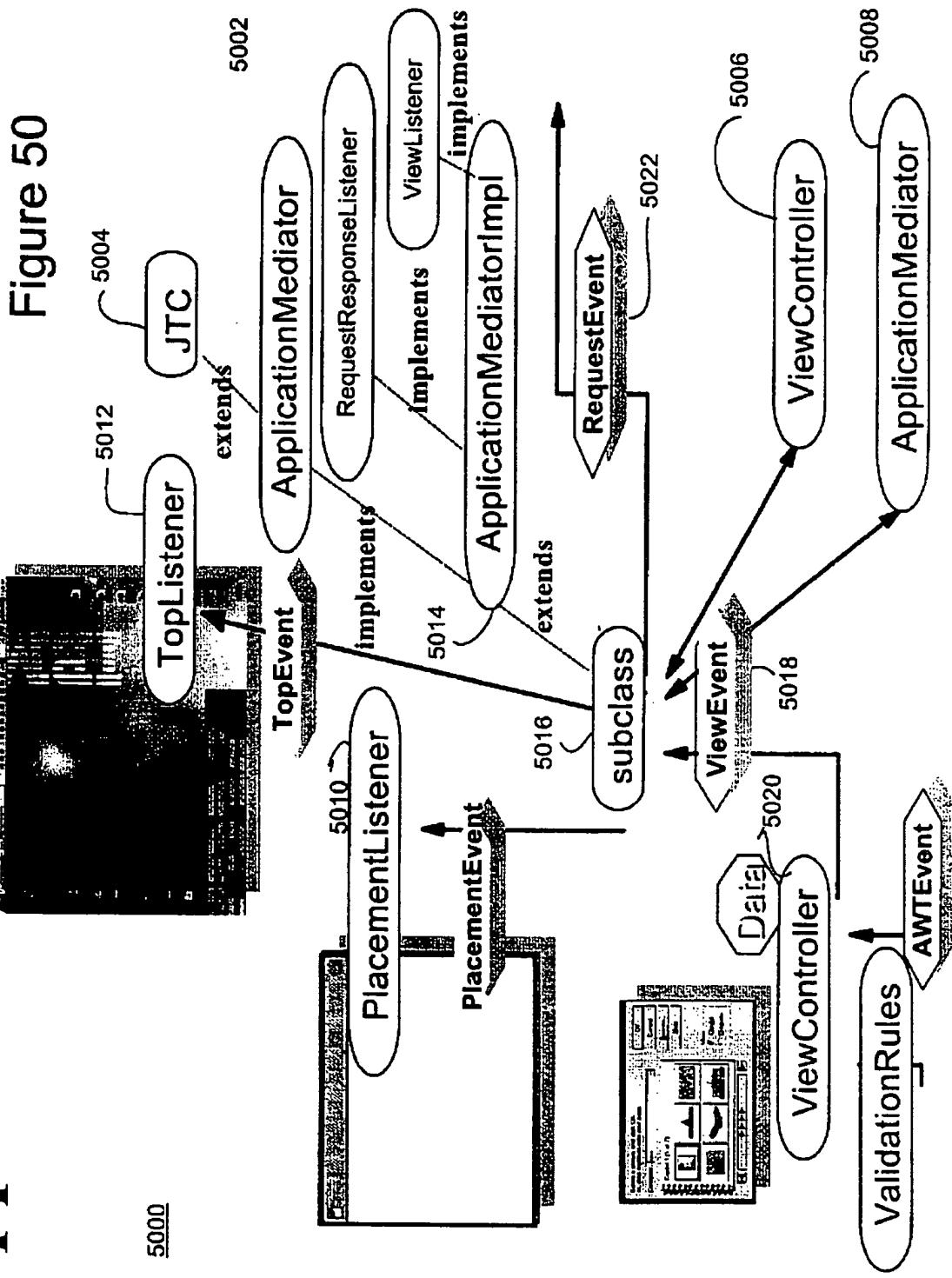
FIGURE 49

- delegation

```
public class ViewControllerBaseImpl implements ViewController {  
    XYZ xyz = new XYZ();  
  
    public java.awt.Component getComponent() {  
        return xyz;  
    }  
  
    public void setEnabled(boolean e) {  
        xyz.setEnabled(e);  
    }  
  
    public void setVisible(boolean v) {  
        xyz.setVisible(v);  
    }  
}
```

ApplicationMediator runtime

Figure 50



AWTEvent threading support

- Style 1 - wait / Queue / notify
- Style 2 - Thread dispatch
- Handles Threading Model for ViewControllers

Figure 51

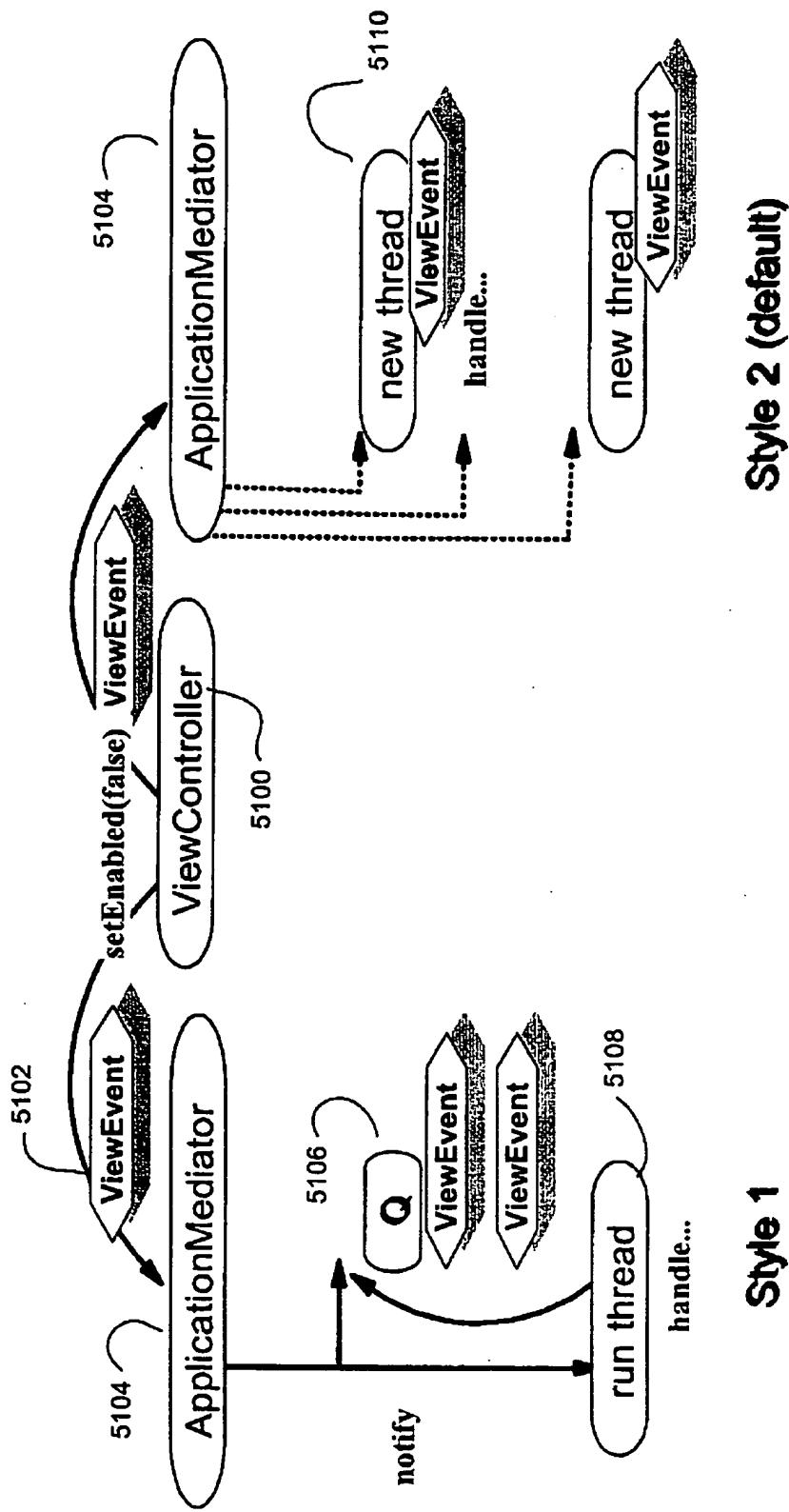
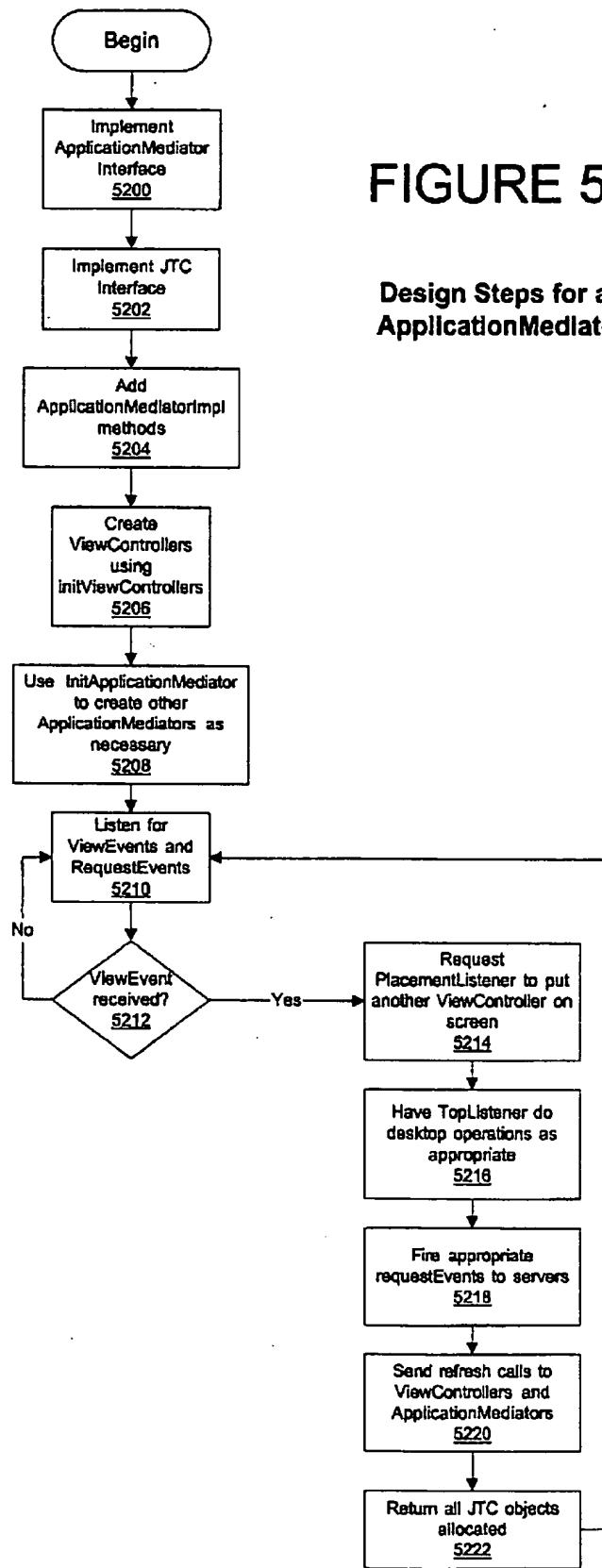


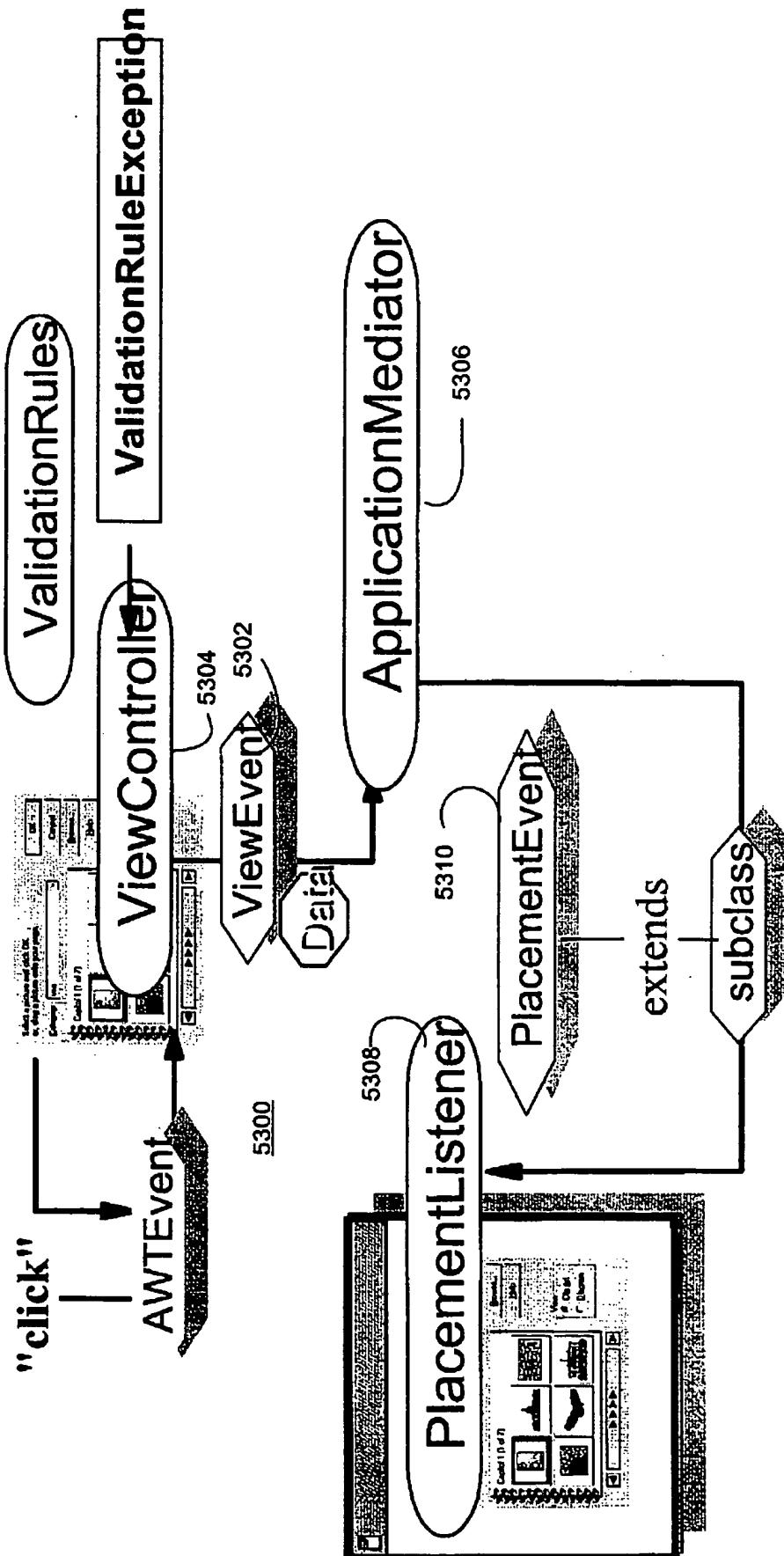
FIGURE 52

Design Steps for an ApplicationMediator



Placement runtime

Figure 53



Placement example

→ Usage from ApplicationMediator

```
// in an ApplicationMediator
int major = PlacementEvent.ADD;
Component component =
customerDetailsViewController.getComponent();
PlacementEvent e = new PlacementEvent(this, component, major);
firePlacementEvent(e);
```

FIGURE 54

→ Usage from PlacementListener

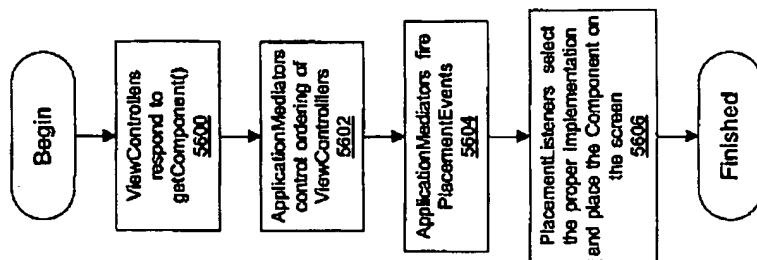
```
public class MyProgram implements PlacementListener {
public void placementEventPerformed(PlacementEvent e) {
    // decide based on source type
    switch (e.getMajor()) {
```

```
case PlacementEvent.ADD:
    if (e.getSource() instanceof PreferenceAm)
        panel1.add("Center", e.getComponent());
    else panel2.add("A", e.getComponent());
    break;
case PlacementEvent.REMOVE:
    // do something else
    break;
}
// etc.
}
```

FIGURE 55

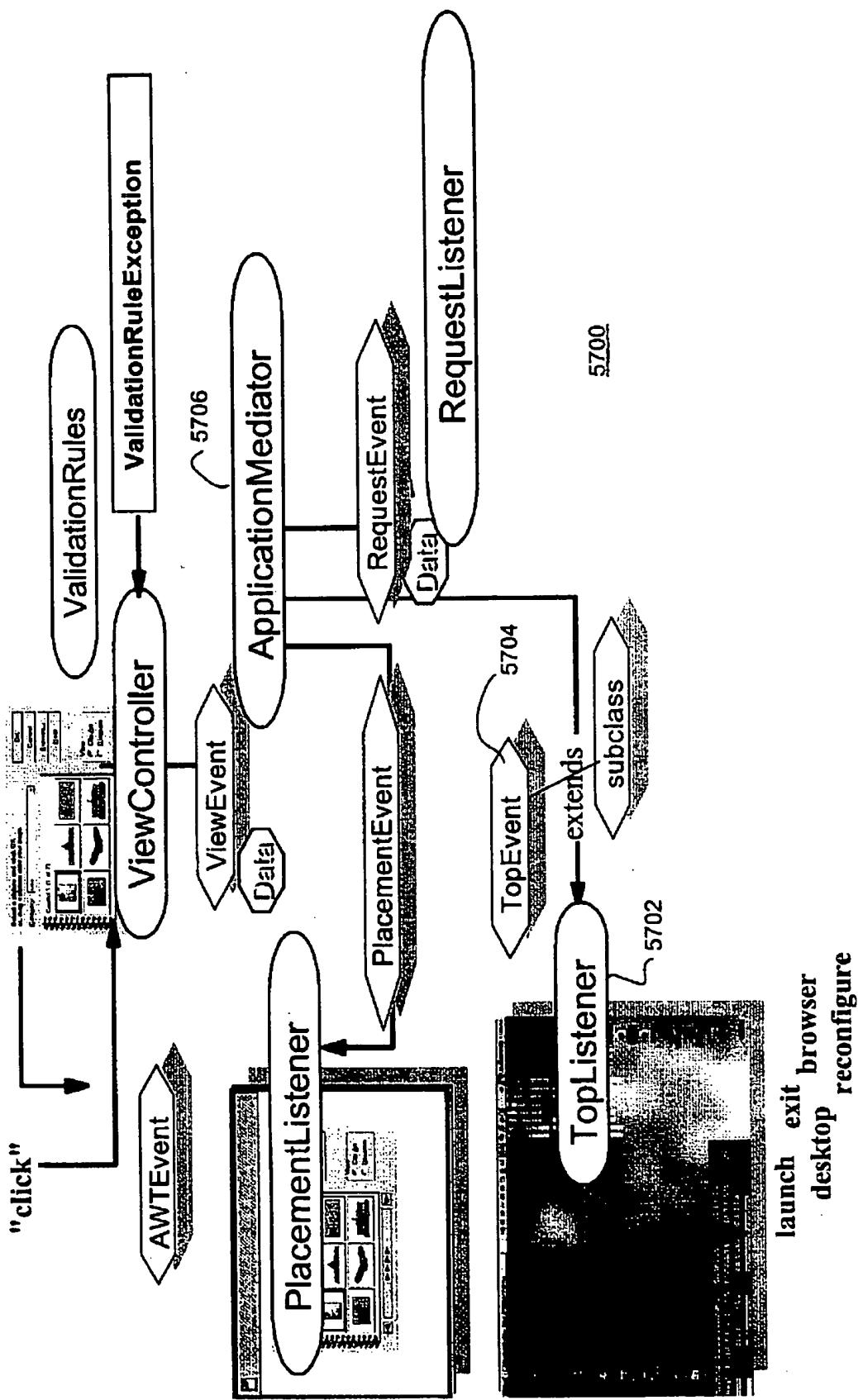
FIGURE 56

**Design Steps for a
PlacementEvent**



TopListener runtime

Figure 57



TopListener example

FIGURE 58

```
// from the TopListener
ApplicationMediatorXYZ m = new ApplicationMediatorXYZ();
m.addTopListener(this);
```

FIGURE 59

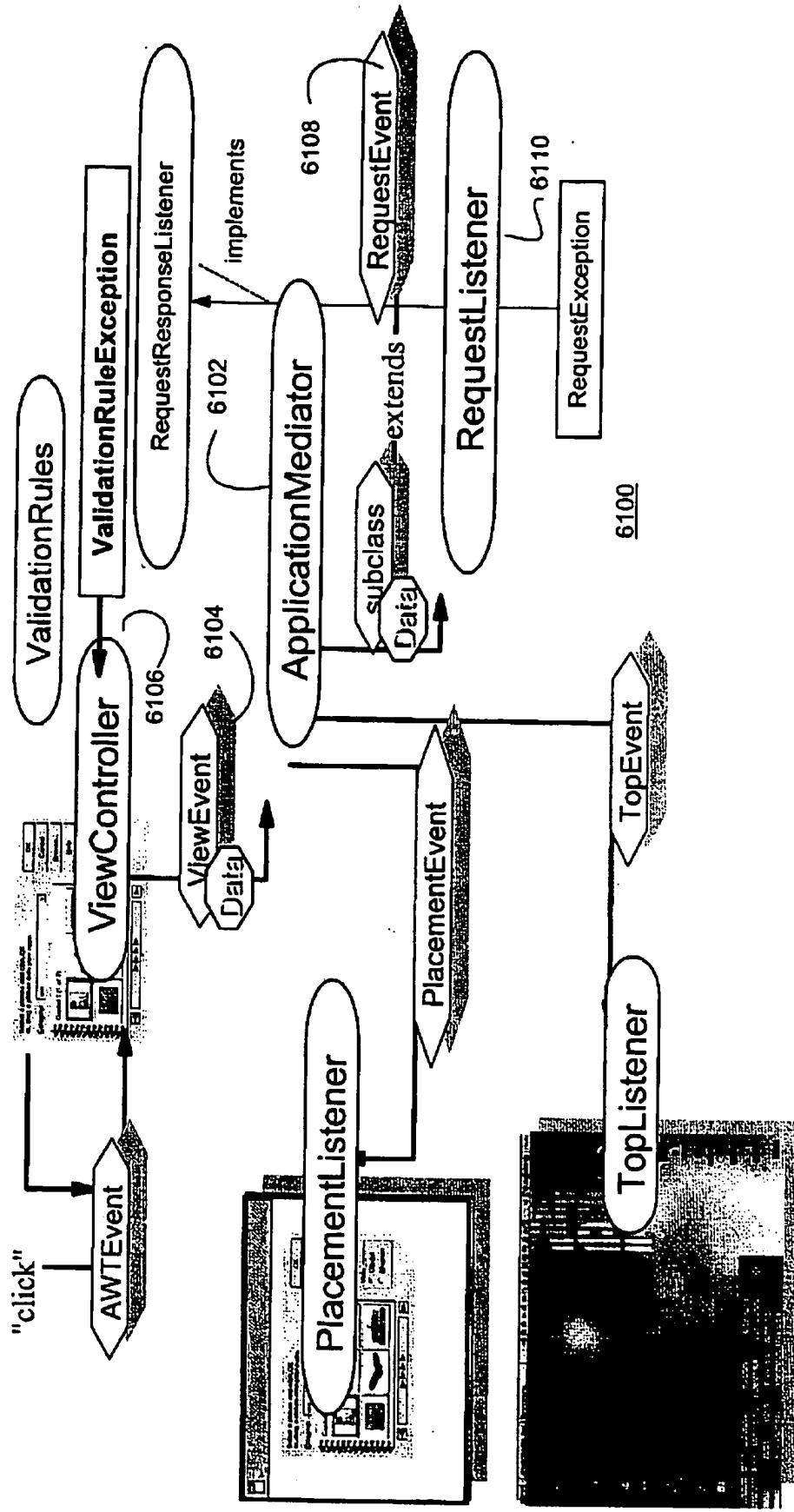
```
// in the ApplicationMediator
String status = "Loading files...";
TopEvent e = new TopEvent(this, TopEvent.STATUS, 0, status);
fireTopEvent(e);
```

FIGURE 60

```
// later in the TopListener callback
public void topEventPerformed(TopEvent e) {
    switch(e.getMajor()) {
        case STATUS:
            // access the browser
            break;
        // etc.
    }
}
```

RequestEvent runtime

Figure 61



RequestEvent example

```
// from an ApplicationMediator - create event
RequestEvent r = new RequestEvent();
r.setMajor("Loans");
r.setMinor("SubmitCustomerInfo");
```

FIGURE

62

```
// fire an asynchronous event
try {
    /asynchronous
    fireRequestEvent(this, r);
}
catch (RequestException yikes) {}
```

FIGURE

63

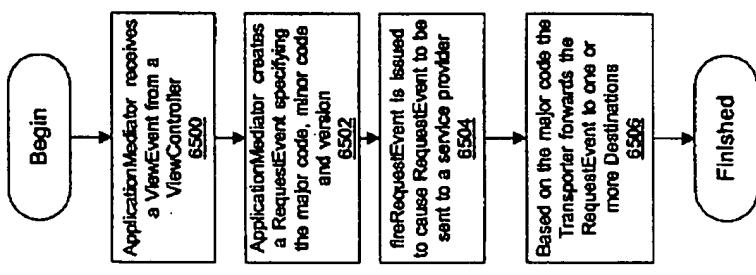
```
// later, called back with success
public void requestResponse(RequestEvent result) {
    //process response
}
// or failure
public void requestException(RequestException yikes) {
    // now what?
}
```

FIGURE

64

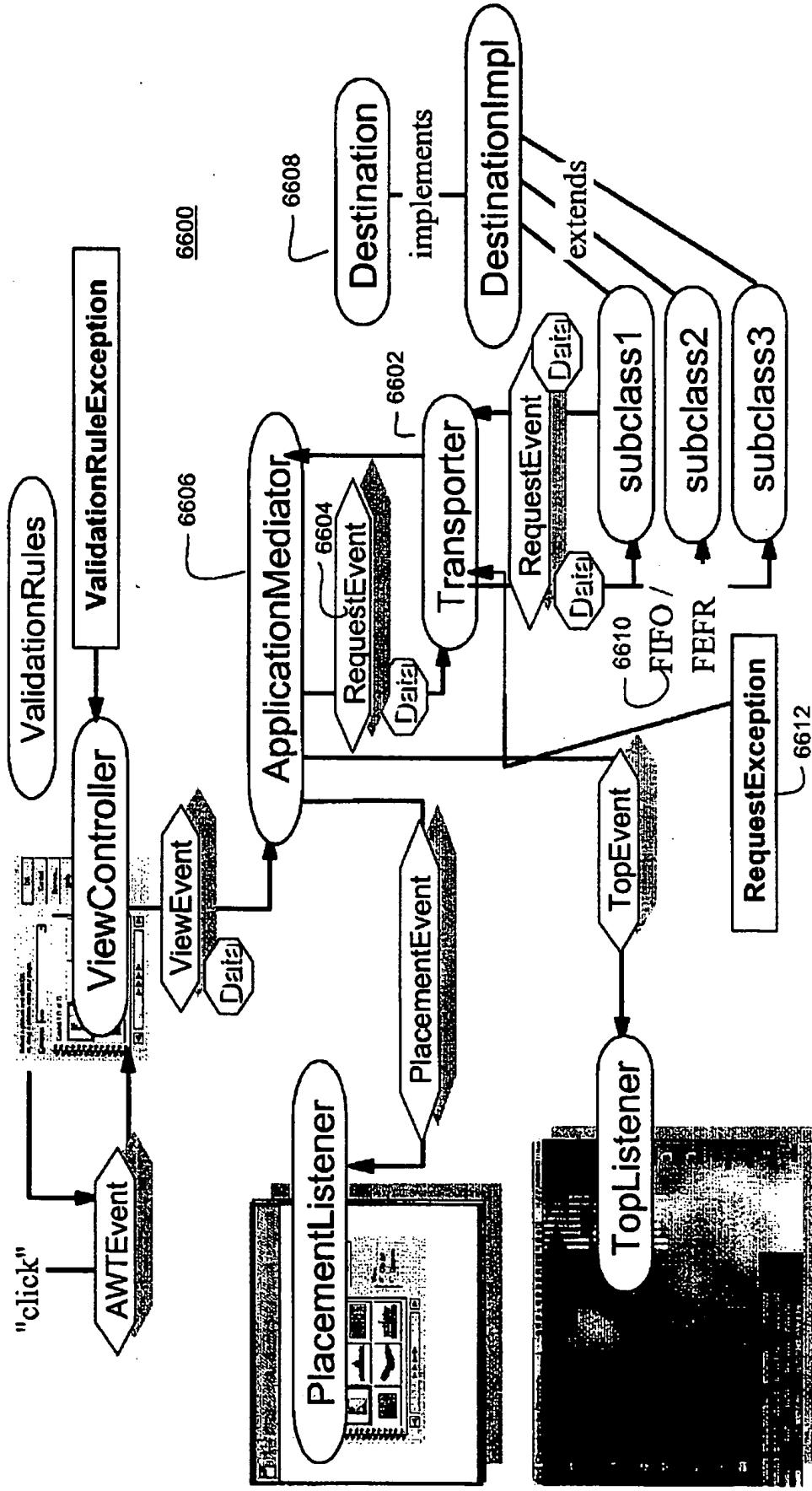
FIGURE 65

Design Steps for a RequestEvent



Transporter runtime

Figure 66



Transporter

- This class implements the JTC and RequestEventListener interfaces
- Its primary function is to map RequestEvents to Destinations.
- Typically ApplicationMediators fire RequestEvents and Destinations process them
- Add a Transporter to an ApplicationMediator to listen for RequestEvents

FIGURE 67

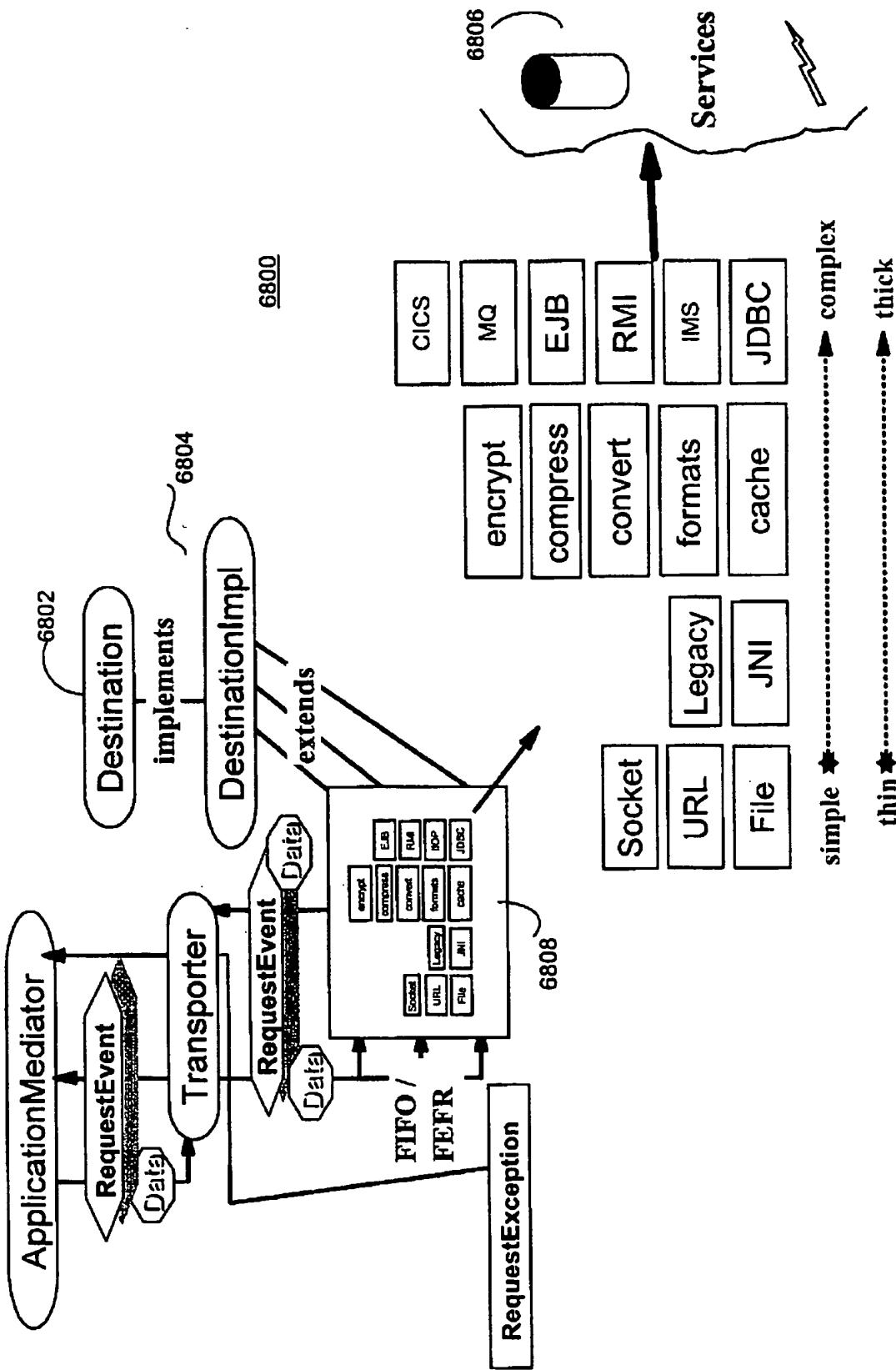
```
Transporter t = new Transporter();  
ApplicationMediator am = new ApplicationMediator();  
am.addRequestListener(t);
```

- The ApplicationMediator will fire RequestEvents

```
RequestEvent r = new RequestEvent(source, major, minor, data);  
try {  
    fireRequestEvent(r);  
}  
catch (RequestException yikes) {}
```

Destination runtime

Figure 68



Destination

- RequestEvents are identified by
 - major code - represents a family of Requests
 - minor code - represents a specific Request
- Destinations are added to the Transporter as DestinationListeners
 - specifying a major code for RequestEvents they are interested in receiving
- The destination is called when the major code of the RequestEvent matches the destination major code

```
EJBDestination d = new EJBDestination();  
Transporter t = new Transporter();  
String major = "Loans";  
t.addDestinationListener(major, d);
```

FIGURE 69

- Multiple Destinations can listen for the same RequestEvent major code
 - processed FIFO / FESP (first in first out, first exception stop forwarding)
 - results of one Destination can be passed to the next Destination

Destinations and major codes

⇒ Special major codes

• wildcard

- "*" major code indicates the Destination is interested in all and any RequestEvents
- processed after specific major codes have been matched.
- priority
- "?" major code indicates the Destination is interested in all requests and should be given priority.
- processing performed before specific major codes and wildcards

⇒ For example

```
Transporter t = new Transporter();
t.addDestinationListener ("*", new WildDestination());
t.addDestinationListener ("Loans", new EJBDestination());
t.addDestinationListener ("!", new PriorityDestination());

//later
RequestEvent r = new RequestEvent(this, "Loans", "", null);
try {
    fireRequestEvent(r);
}
catch (RequestException yikes) {}
```

FIGURE
70

- The RequestEvent "r" will be sent to PriorityDestination 1st, EJBDestination 2nd, and WildDestination() 3rd, assuming no RequestExceptions are thrown.

getJTCs example

FIGURE
71

```
// Recursively look at the root, find each JTC and/or AWT and hook
public void hookJTCs(JTC root) {
    Vector jtcbs = null;
    try {
        jtcbs = root.getJTCs();
    } catch (Exception none) { return; } // should not happen

    if (jtcbs == null) return; //we are done

    int size = jtcbs.size();
    for (int j = 0; j < size; j++) {
        Object current = jtcbs.elementAt(j);
        if (current instanceof ApplicationMediator) {
            hookAM((ApplicationMediator) current);
        } else
            if (current instanceof ViewController) {
                hookVC((ViewController) current);
            } else
                if (current instanceof Transporter) {
                    hookTransporter((Transporter) current);
                } else
                    if (current instanceof java.awt.Component) {
                        //once into AWT tree, never back to JTCs
                        hookAWT((java.awt.Component) current);
                        continue;
                    }
    }
    hookJTCs((JTC) jtcbs.elementAt(j)); //recursive
}
```

hookJTC helpers

FIGURE
72

```
/*
 * Hook the ApplicationMediator
 */
public void hookAM(ApplicationMediator am) {
    vcl.refresh("ApplicationControllers found:" + am);
    am.addViewListener(this);
    am.addRequestListener(this);
    vcl.refresh("....add as ViewListener");
    vcl.refresh("....add as RequestListener");
}

/*
 * Hook the ViewController and its getComponent()
 */
public void hookVC(ViewController vc) {
    vcl.refresh("ViewController found:" + vc);
    vc.addViewListener(this);
    vc.refresh("....add as ViewListener");
    hookAWTS(vc.getComponent());
}

/*
 * Hook the Transporter
 */
public void hookTransporter(Transporter transporter) {
    vcl.refresh("Transporter found:" + transporter);
    transporter.addDestinationListener("1", this);
    vcl.refresh("....add as DestinationListener");
}
```

hookAWT's

FIGURE

73

```
// Recursively find each AWT object and hook
public void hookAWT's(Component comp) {
    if (component instanceof Container) {
        val.refresh("Container found: " + comp);
        Component[] comps = ((Container) comp).getComponents();
        int size = comps.length;
        for (int i = 0; i < size; i++) {
            hookAWT's(comps[i]);
        }
    }
    /* continue here since some regular Components, such as JLabels,
     * are Containers also.
    */
    if (comp instanceof Button) {
        hookAWTButton((Button) comp);
    } else
    if (comp instanceof JButton) {
        hookSwingJButton((JButton) comp);
    } else
        if (component instanceof JTextField) {
            hookSwingJTextField((JTextField) comp);
        }
    /*....else do over every other Bean/Component/Container
     * type possibly using reflection or a table driven
     * implementation.
    */
}
```

hookAWTs - helpers

FIGURE
74

```
/*
 * Hook the java.awt.Button
 */
public void hookAWTButton(Button button) {
    vcl.refresh("java.awt.Button found:" + button);
    button.addActionListener(this);
    vcl.refresh("....add as ActionListener");
}

/*
 * Hook the com.sun.java.swing.JButton
 */
public void hookswingJButton(JButton button) {
    vcl.refresh("com.sun.java.swing.JButton found:" + button);
    button.addActionListener(this);
    button.addChangeListener(this);
    button.addItemListener(this);
    vcl.refresh("....add as ActionListener");
    vcl.refresh("....add as ChangeListener");
    vcl.refresh("....add as ItemListener");
}

/*
 * Hook the com.sun.java.swing.JTextField
 */
public void hookswingJTextField(JTextField textField) {
    vcl.refresh("com.sun.java.swing.JTextField found:" + textField);
    textField.addActionListener(this);
    textField.addCaretListener(this);
    vcl.refresh("....add as ActionListener");
    vcl.refresh("....add as CaretListener");
}
```

FIGURE 75

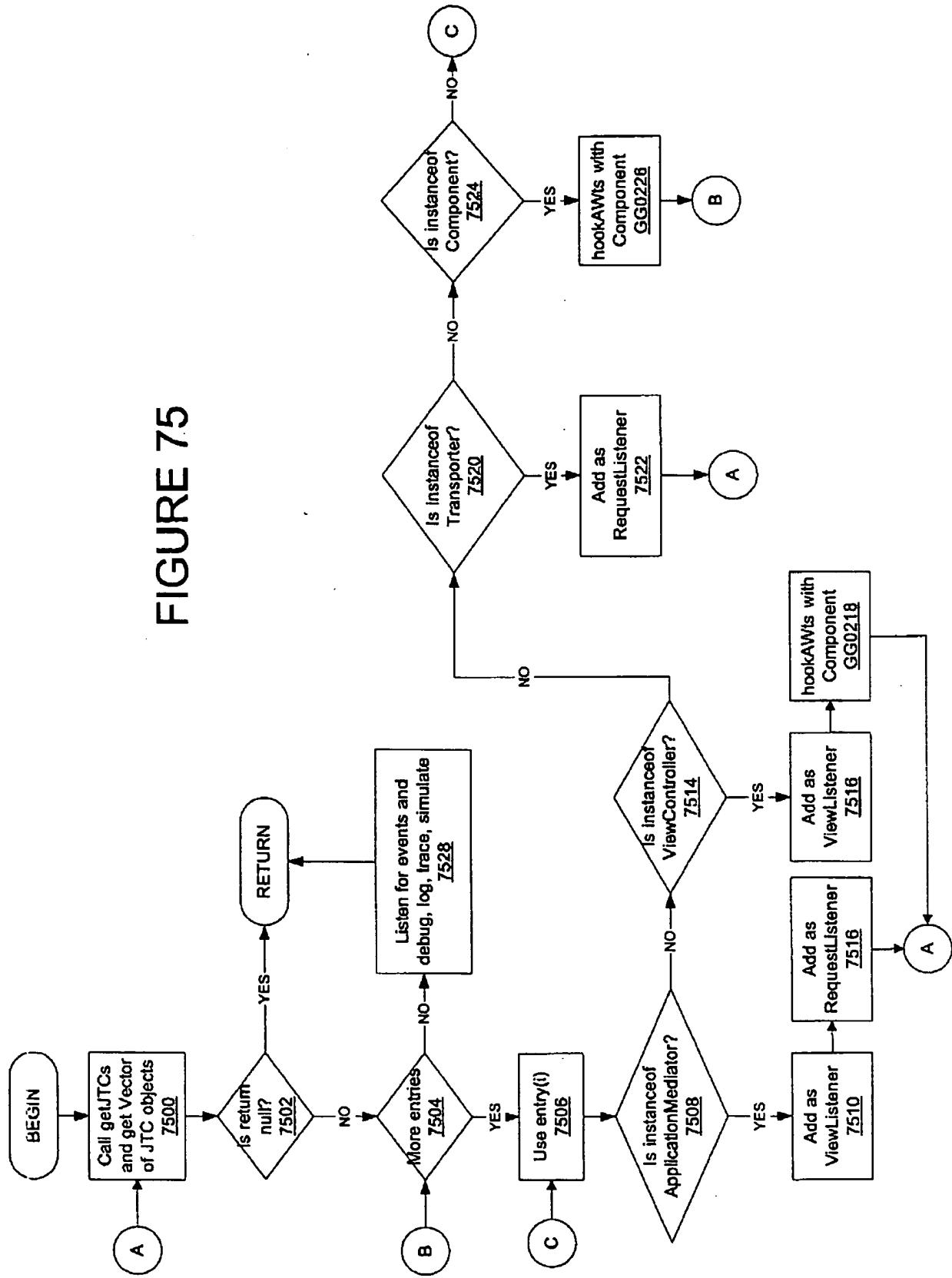


Figure 76

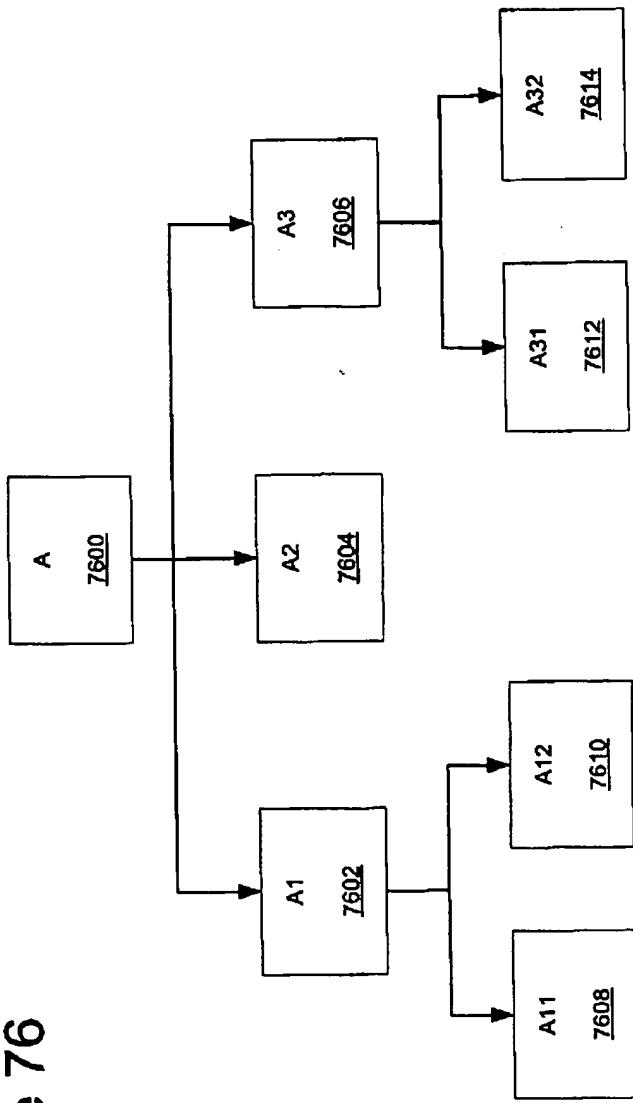
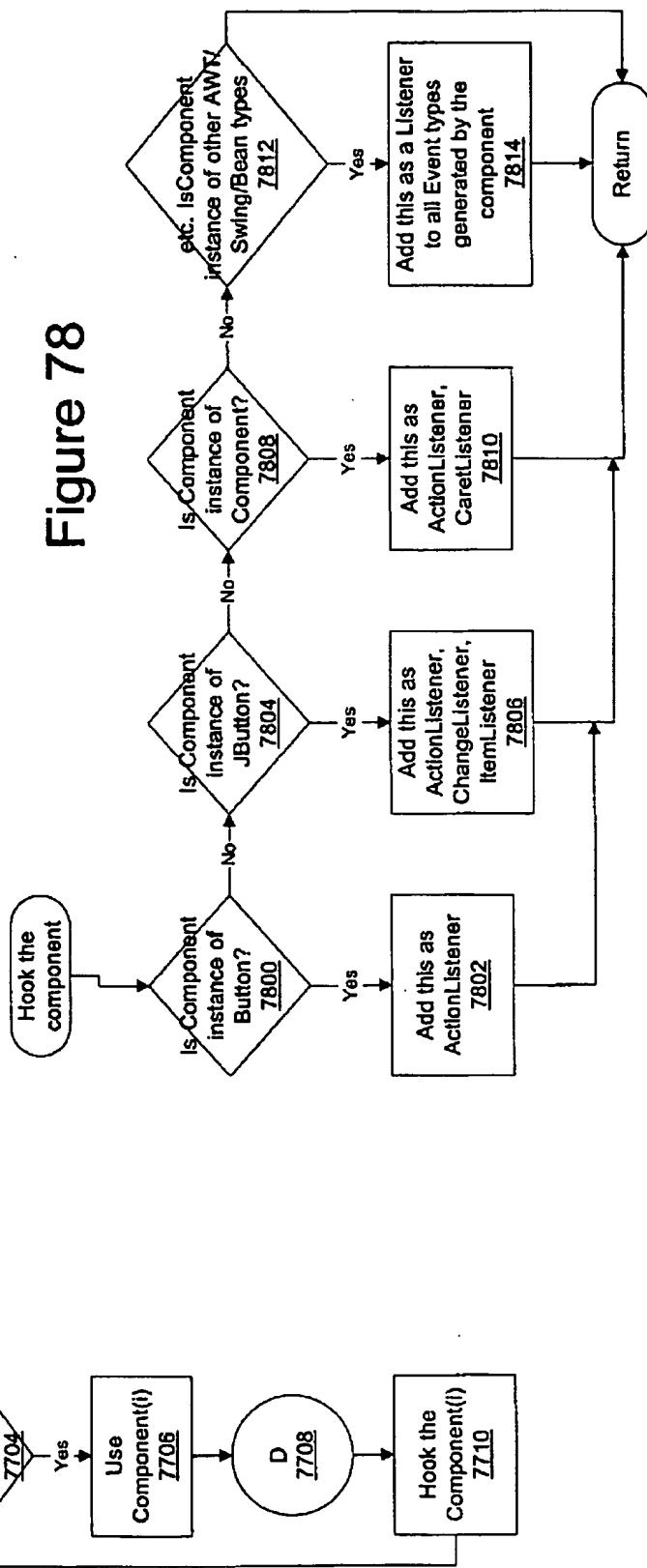




Figure 78



Data Objects

- ✓ The ApplicationMediatorImpl will forward the refresh (default)

FIGURE
79

```
for each: ApplicationMediator -> refresh(data)
for each: ViewController -> refresh(data) ?
```

- ✓ The ViewController will update the GUI

```
public void refresh(Object data) {
    //this example uses a key/value pair data model
```

FIGURE
80

```
if (data == null) return;
else refresh( (KeyValue) data) ;
}

public void refresh (KeyValue data) {
    nameField.setText (data.get ("CustomerName") );
    idField.setText (data.get ("CustomerId") );
    repaint(); //if necessary
}
```

Data Objects

✓ How can we add a new data model (i.e. real objects)?

FIGURE
81

```
public void refresh(Object data) {
    if (data == null) return;
    else if (data instanceof Vector) {
        refresh((Vector) data);
    }
    else if (data instanceof KeyValue) {
        refresh((KeyValue) data);
    }
}
```

FIGURE
82

```
public void refresh(Vector data) {
    //I know what they are
    Customer c = (Customer) data.elementAt(0);
    ID id = (ID) data.elementAt(1);
    nameField.setText(c.getName());
    idField.setText(id.toString());
    repaint(); //if necessary
}
```

More on data

Figure 83

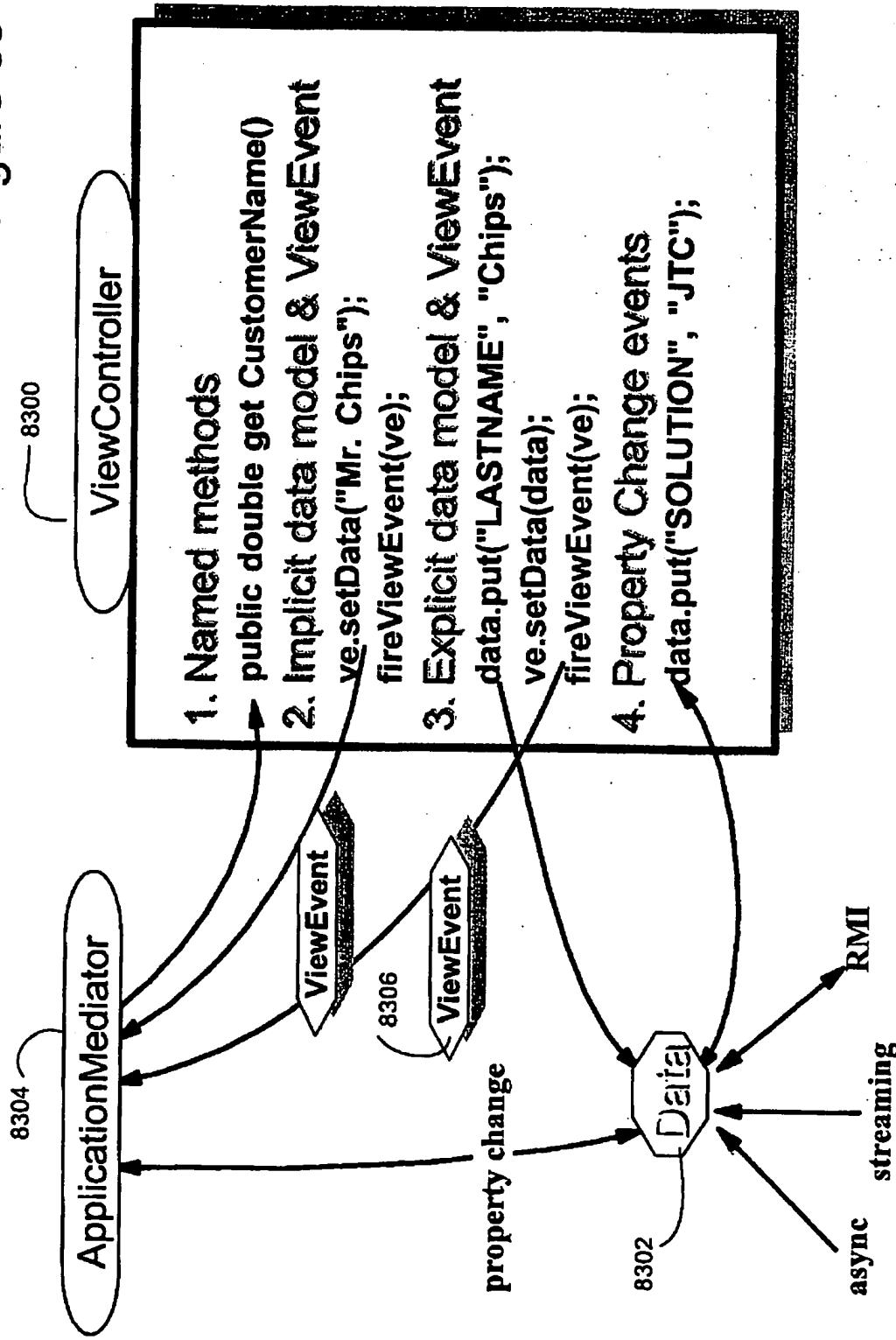


Figure 84

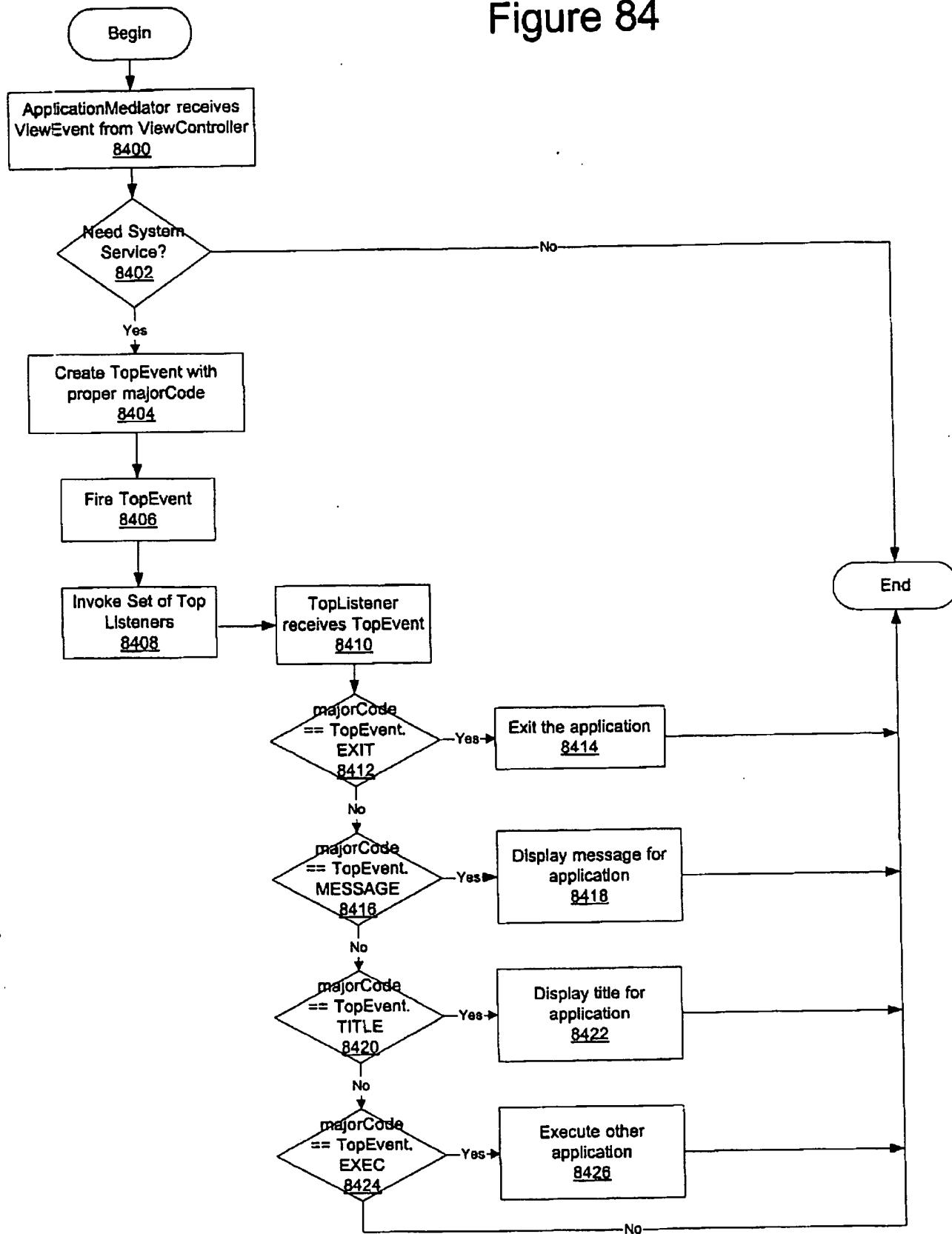


Figure 85

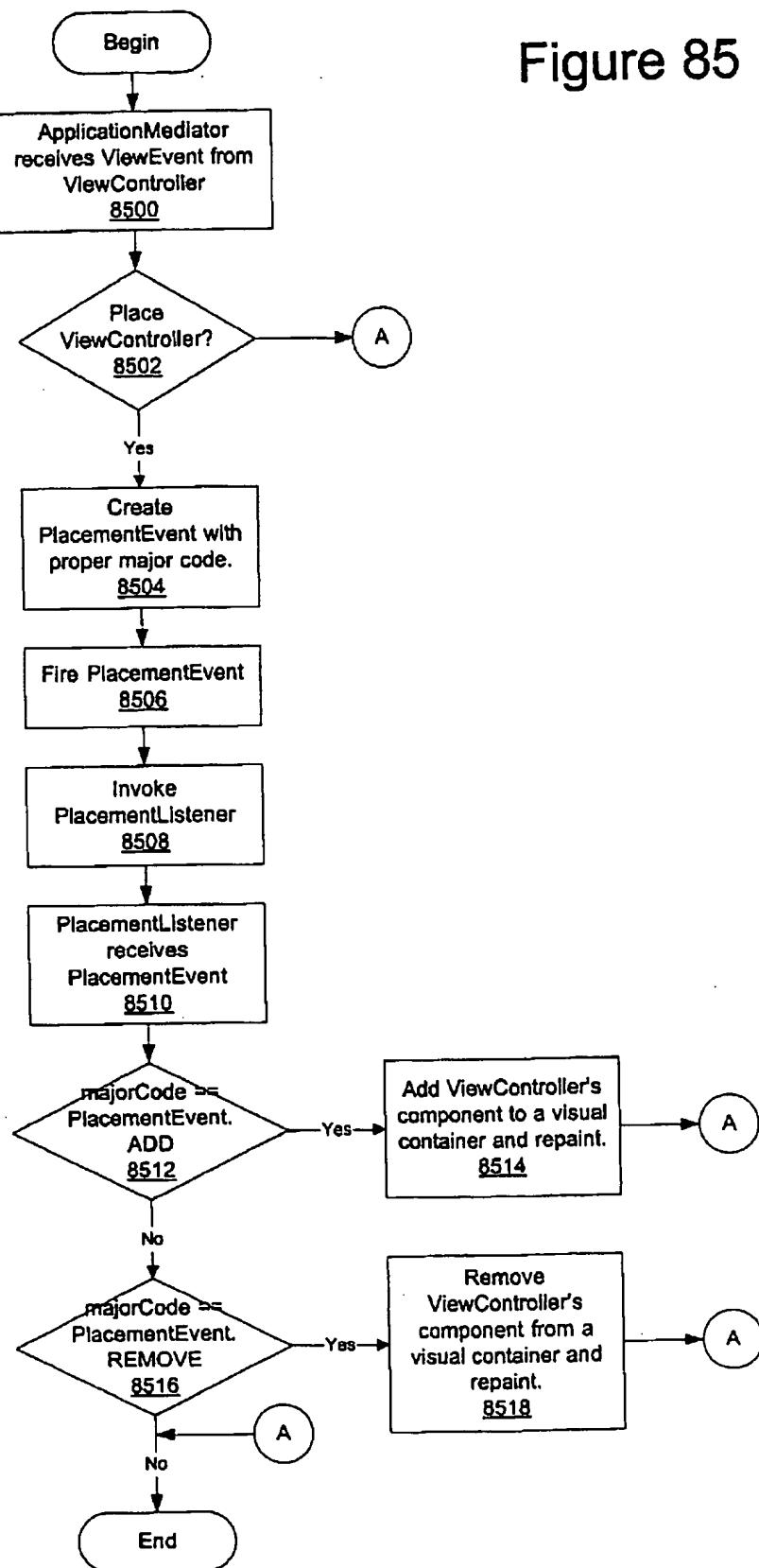


FIGURE 86

Handling AWTEvents

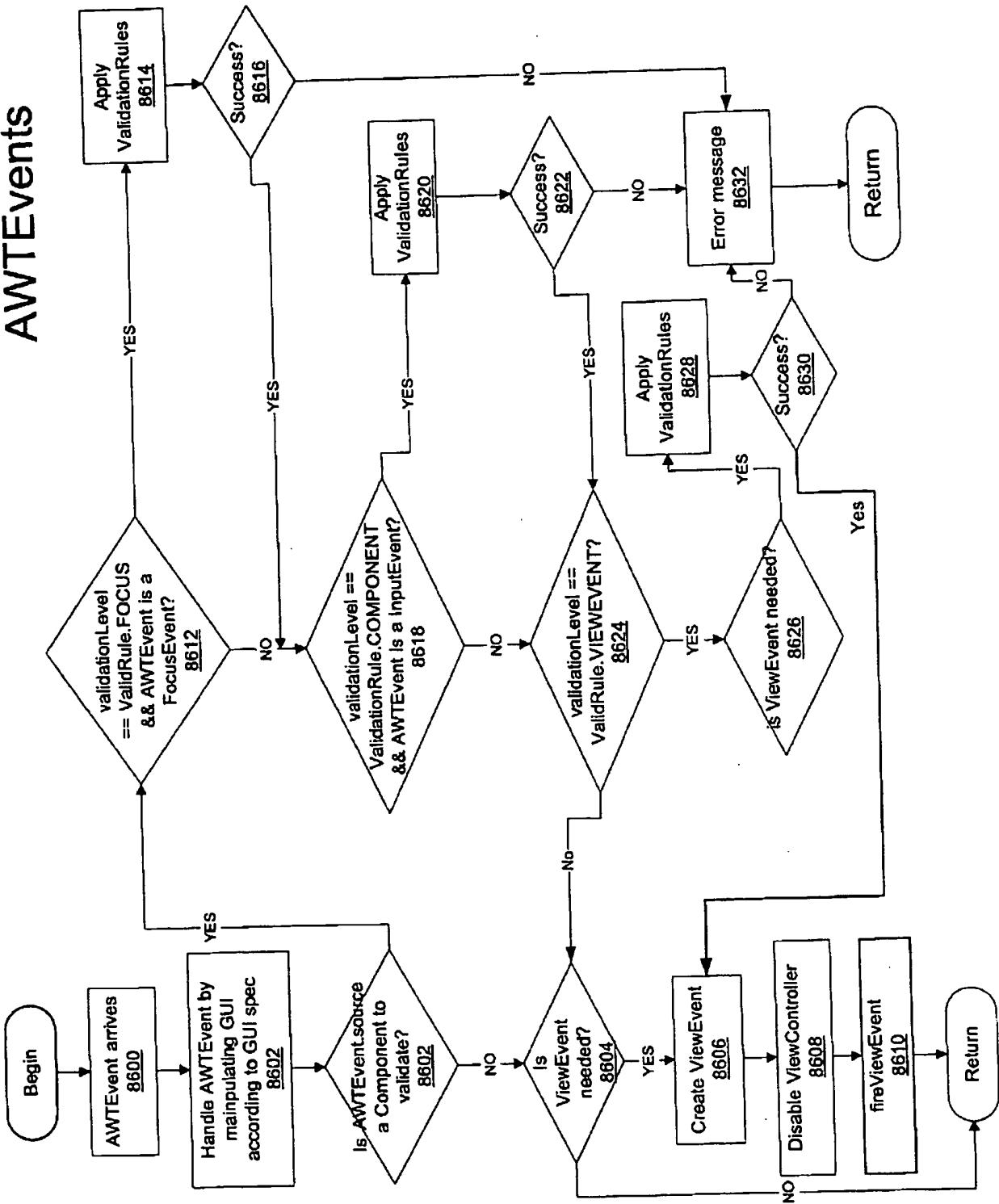




FIGURE 88

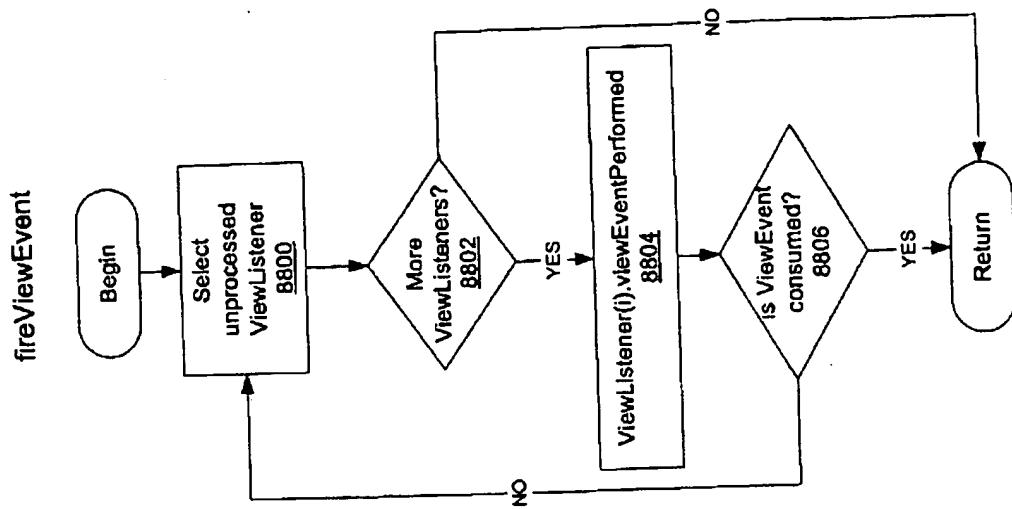


Figure 89
Application Manager

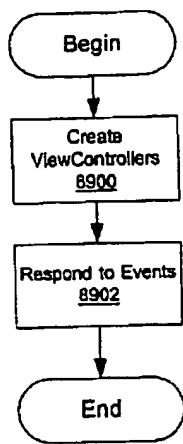


Figure 91
Application Manager

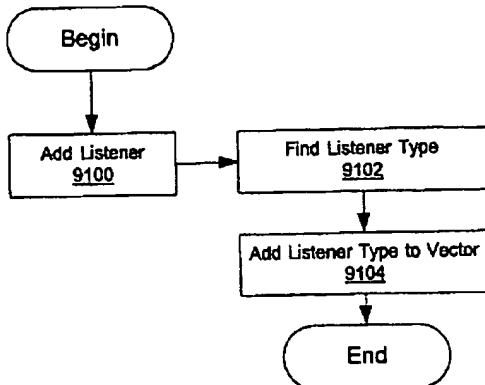


Figure 90
Application Manager

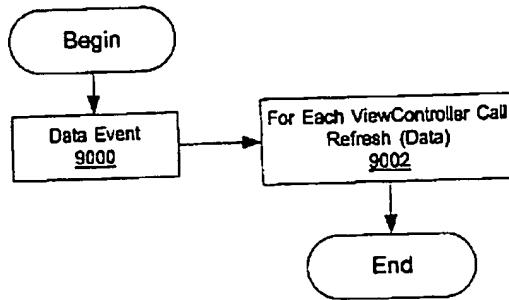


Figure 92
Application Manager

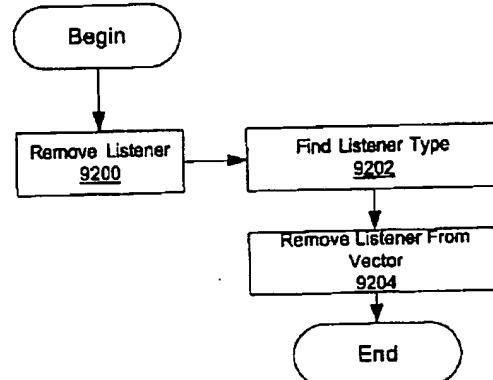


Figure 93
Application Manager

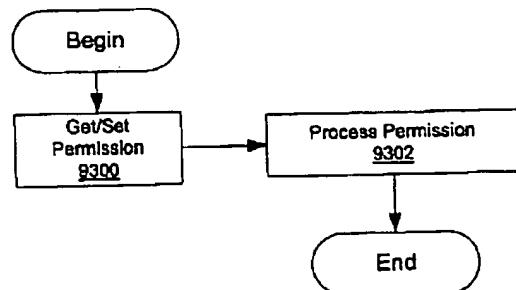


Figure 94
Application Manager

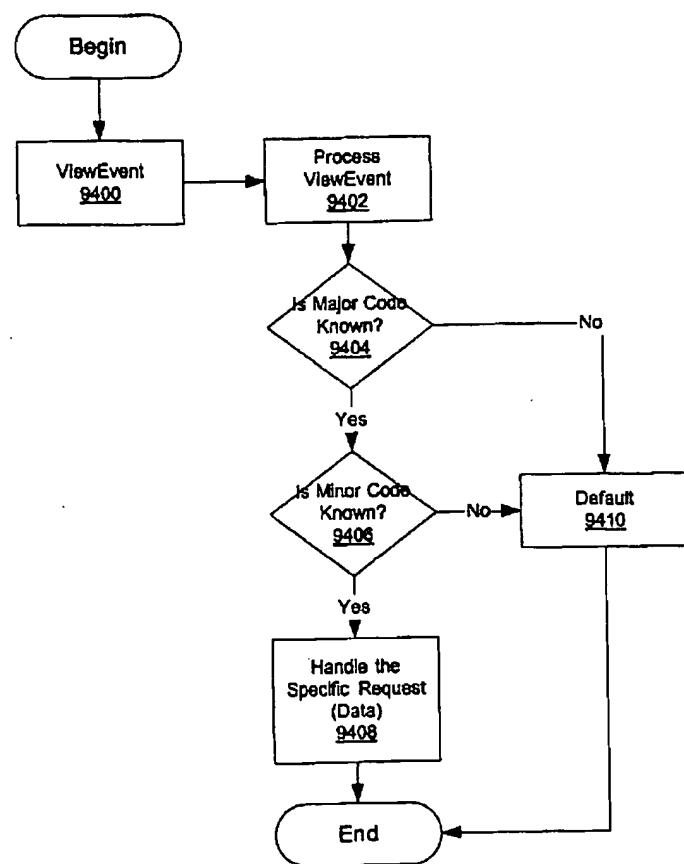


Figure 95
Application Manager

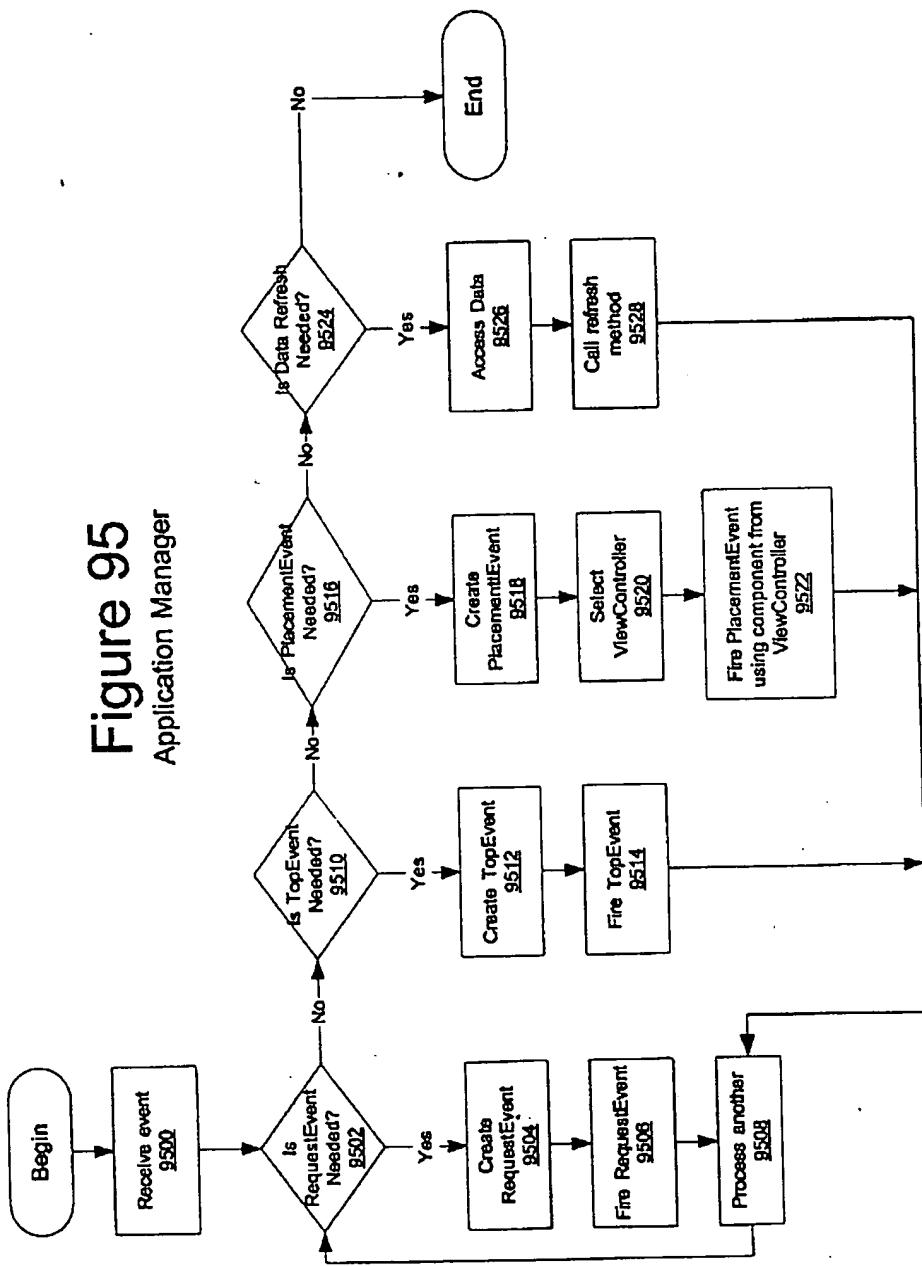


FIGURE 96

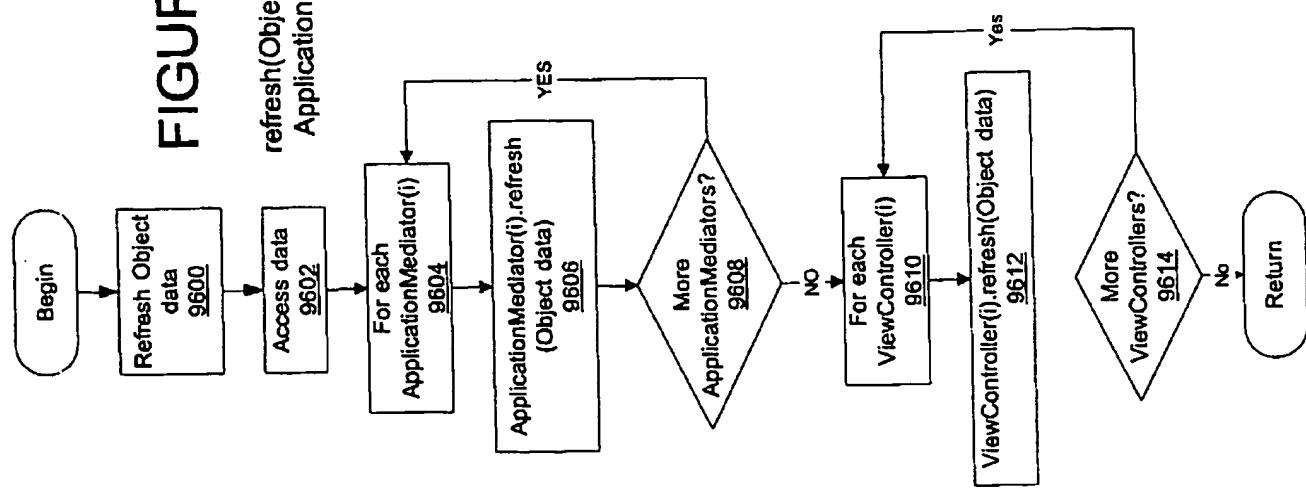


FIGURE 97

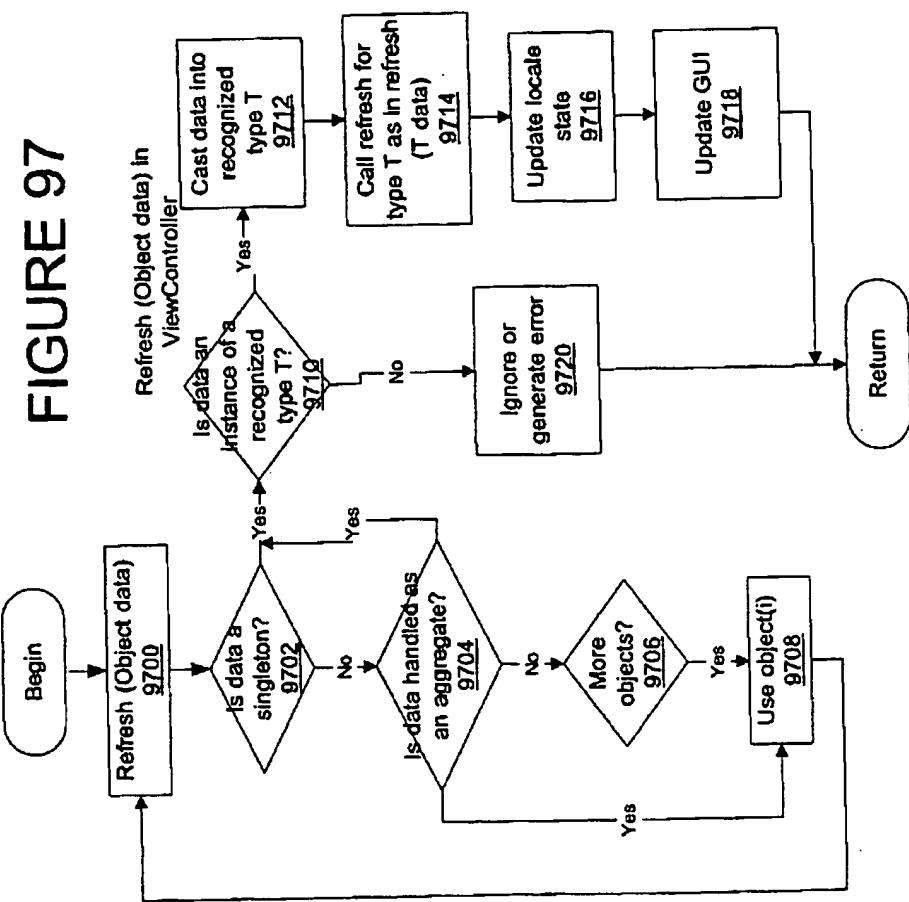


FIGURE 98

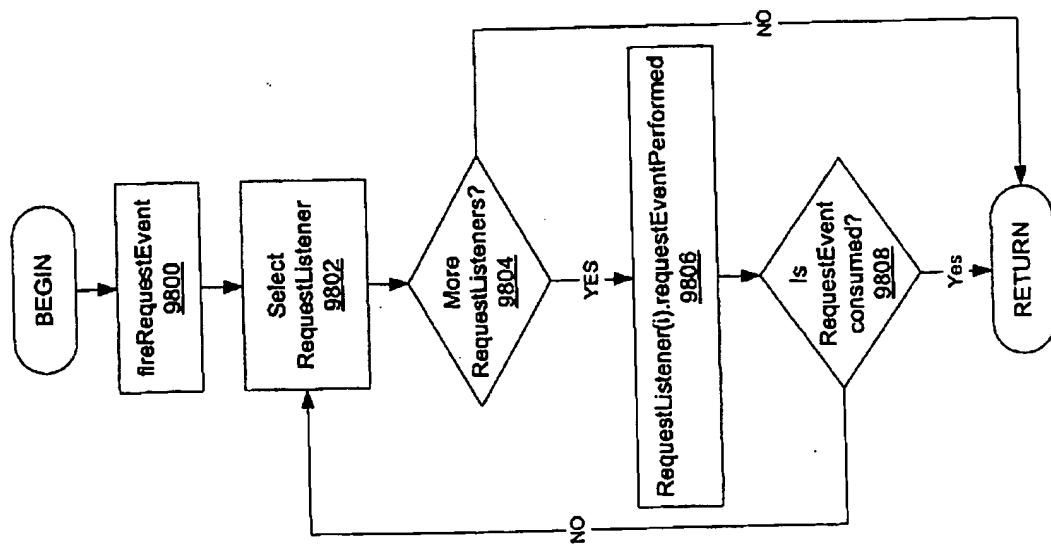


Figure 99

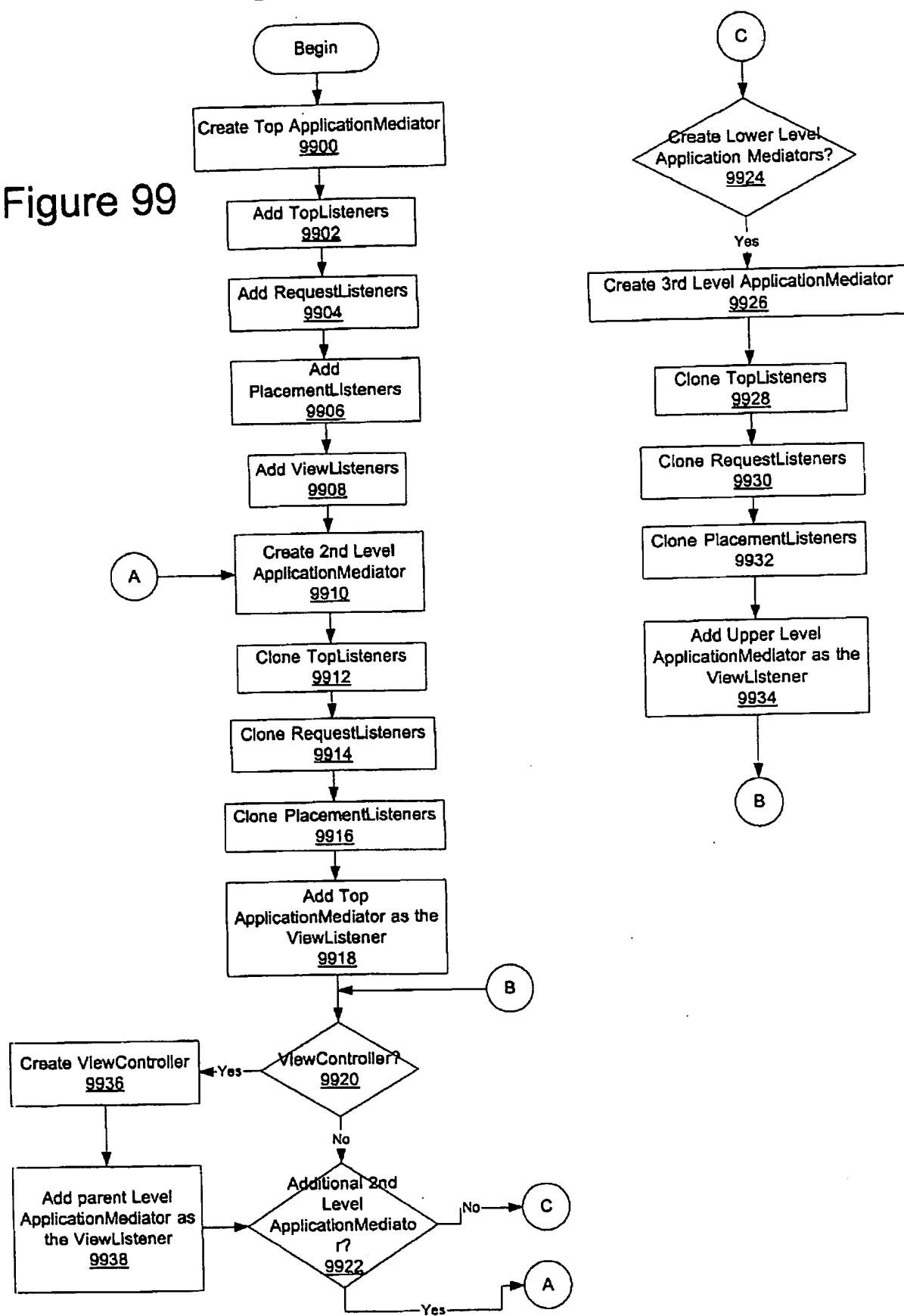


Figure 100

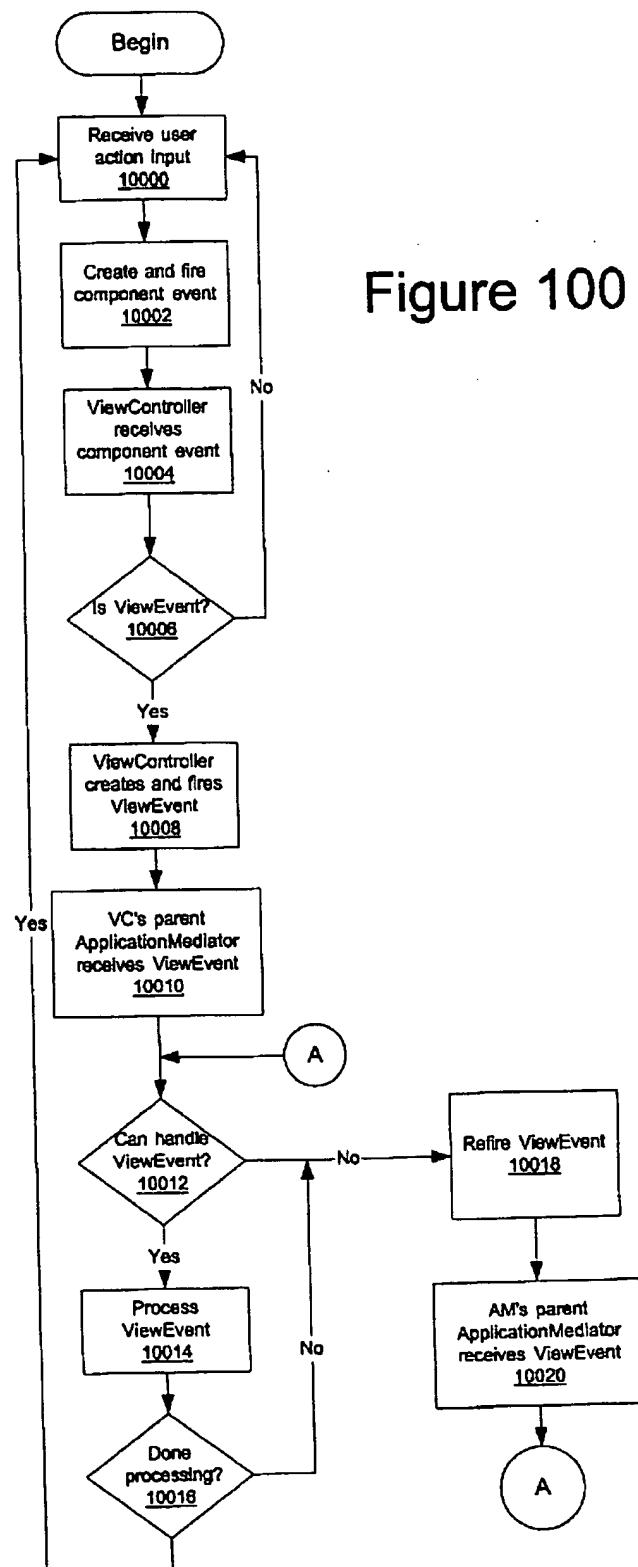


FIGURE 101

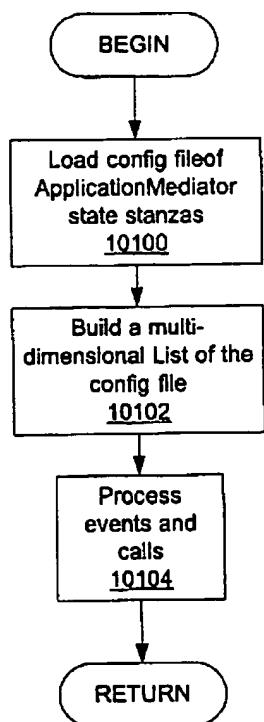


FIGURE 102

Encoding ApplicationMediators

- S1: (VE.source=vc1 && VE.major=A && VE.minor=B) =>
(RE.major=C RE.minor=D RE.data=VE.data RE.fireS)
if event source is vc1 with A,B as major/minor then
fire sync request with C,D major/minor and use data from event)
- S2: (VE.source=vc4 && VE.major=5) => (TE.major=3 TE.fire)
if event source is vc4 with 5 as major then
fire top event with major 3
- S3: (Refresh) => (VC.i.refresh(Refresh.data))
if refresh(data) occurs, then refresh all view controllers with the
same data, but not the other application mediators
- S4: (VE.source=vcA) => (RE.major="set" RE.fireA) &&
(PE.major=PE.ADD PE.source=vcB PE.fire) && (VC.vcB.refresh(RE.data))
if event source is vcA, then fire sync request, then fire placement
event, then refresh the newly placed view controller with the data
returned with the request

FIGURE 103

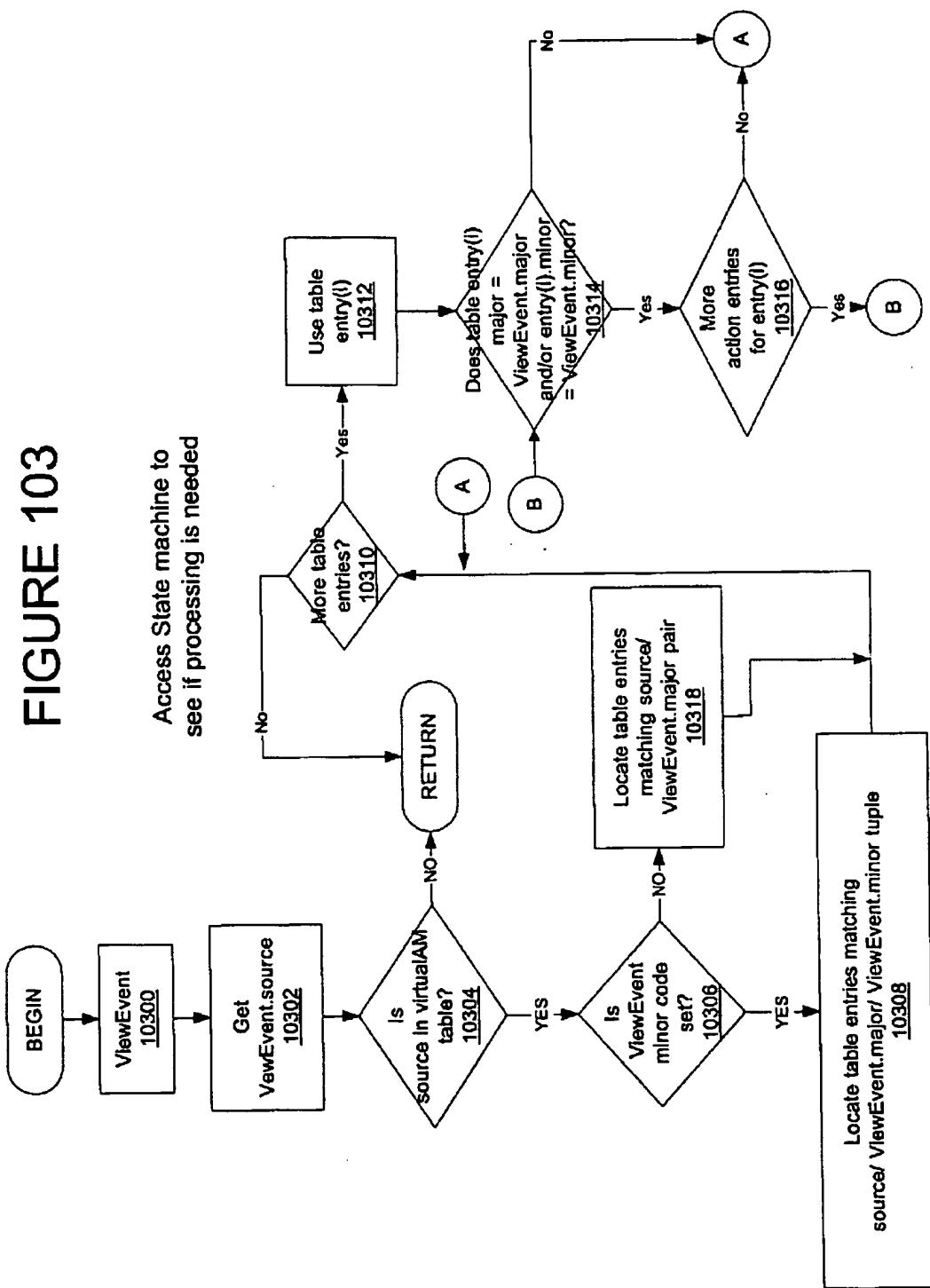


FIGURE 104

Process actions for each ViewEvent

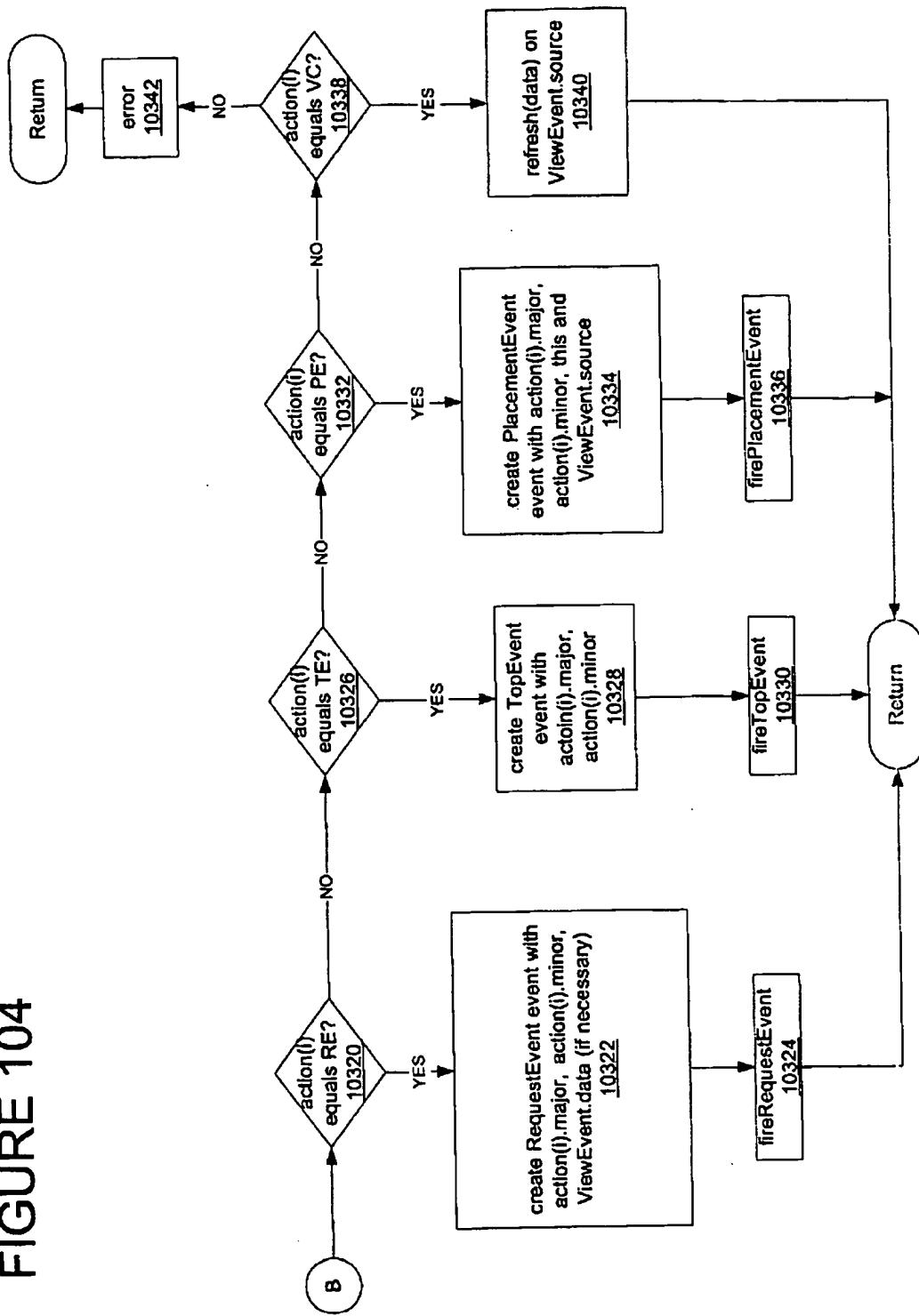


Figure 105

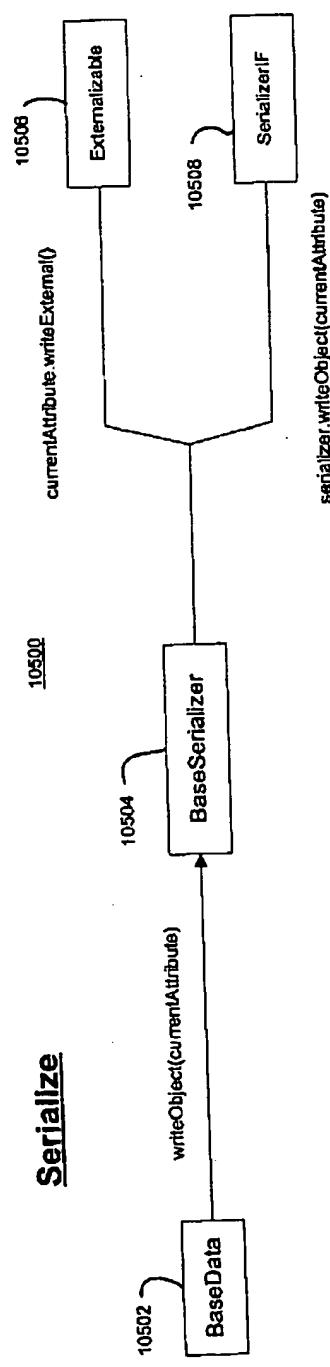


Figure 106

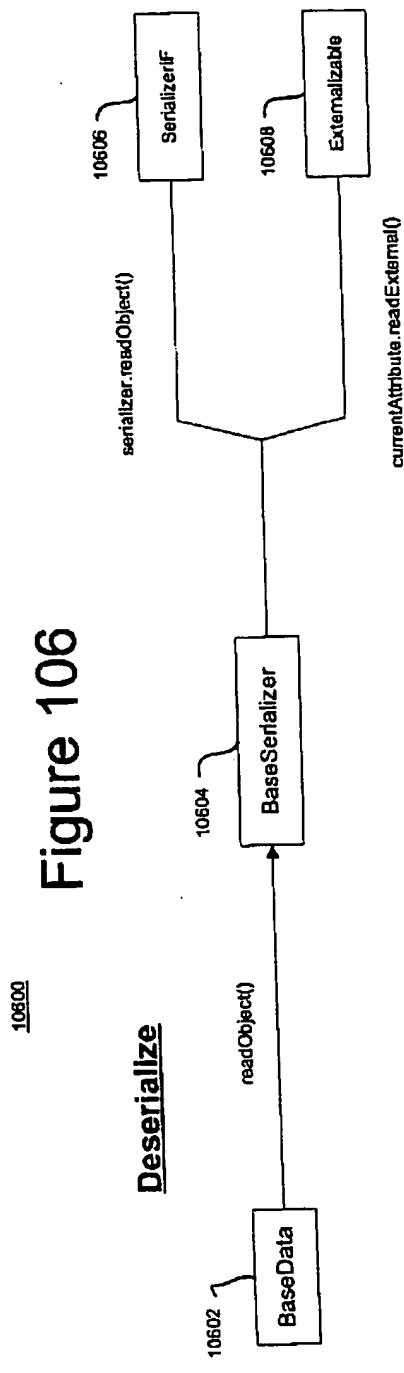


Figure 107

```
package com.ibm.jtcx.serialization;

import java.io.Externalizable;
import java.io.IOException;
import java.io.ObjectInput;
import java.io.ObjectOutput;
/**
 * Default type comment.
 *
 * <P>INVARIANT:
 */
public class BaseData implements Externalizable {
    private Object[] data = null;
    /**
     * BaseData constructor comment.
     */
    public BaseData() {
        this(0);
    }
    /**
     * BaseData constructor comment.
     * @param dataArray java.lang.Object[]
     */
    public BaseData(int count) {
        super();
        setData(new Object[count]);
    }
    /**
     * Default method comment.
     *
     * <P>PRE:
     * <P>POST:
     *
     * @return Parameter not modified
     * @return java.lang.Object[]
     */
    public final Object[] getData() {
        return data;
    }
}
```

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pg 1

```

/*
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @return java.lang.Object
 * @param index int
 */
public final Object getData(int index) {
    Object retVal = null;

    if ((data != null) && (index < data.length)) {
        retVal = data[index];
    }

    return retVal;
}
/** 
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @param in ObjectInput
 */
public void readExternal(ObjectInput in)
    throws ClassNotFoundException, IOException {
    setData((Object[])in.readObject());
}
/** 
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @param dataArray java.lang.Object[]
 */
public final void setData(Object[] dataArray) {
    data = dataArray;
}

```

Figure 107

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pg 2

Figure 107

```
/*
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @param index int
 * @param dataElement java.lang.Object
 */
public final void setData(int index, Object dataElement) {
    if ((data != null) && (index < data.length)) {
        data[index] = dataElement;
    }
}
/*
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @param out ObjectOutput
 */
public void writeExternal(ObjectOutput out) throws IOException {
    out.writeObject(getData());
}
```

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pg 3

Figure 108

```
package com.ibm.jtcx.serialization;

import java.io.Externalizable;
import java.io.IOException;
import java.io.ObjectInput;
import java.io.ObjectOutput;
import java.math.BigDecimal;
import java.math.BigInteger;
import java.util.Date;
import java.util.Enumeration;
import java.util.GregorianCalendar;
import java.util.Hashtable;
import java.util.SimpleTimeZone;
import java.util.TimeZone;
import java.util.Vector;
/**
 * Base class of data objects that require small serialization. The
 * attributes of the data object are stored in an array and the elements
 * of the array are written individually.
 *
 * <P>INVARIANT:
 */
public class BaseDataS extends BaseData implements Externalizable {
/**
 * Default constructor.
 */
public BaseDataS() {
    super();
}
/**
 * Creates a new <code>BaseDataS</code> object with a data array of
 * size <code>count</code>.
 *
 * @param count the size of the data array containing the attributes
 */
public BaseDataS(int count) {
    super(count);
}
```

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pg 1

```

}

/***
 * Reads the array of data elements from the stream. The responsibility
 * of reading the individual element is left to the
 * <code>BaseSerializer</code> via <code>readObject()</code>.
 *
 * @param in the input stream that contains the serialized object
 * @exception ClassNotFoundException thrown if
 * <code>BaseSerializer</code> fails to read the object from the stream
 * @exception IOException thrown if
 * <code>BaseSerializer</code> fails to read the object from the stream
 * @see BaseSerializer#readObject
 */
public void readExternal(ObjectInput in)
    throws ClassNotFoundException, IOException {
    int size = in.readShort();

    if (size == -1) {
        setData(null);
    } else {
        Object[] array = new Object[size];

        for (int i = 0; i < size; i++) {
            array[i] = BaseSerializer.getInstance().readObject(in);
        }

        setData(array);
    }
}

/***
 * Writes the array of data elements. The responsibility of writing the
 * data elements is left to <code>BaseSerializer</code> via
 * <code>writeObject()</code>.
 *
 * @param out the output stream to which the data elements will be
 * written
 */
public void writeExternal(ObjectOutput out) throws IOException {
    Object[] array = getData();

    if (array == null) {
        out.writeShort(-1);
    } else {
        out.writeShort(array.length);

        for (int i = 0; i < array.length; i++) {
            BaseSerializer.getInstance().writeObject(out, array[i]);
        }
    }
}

```

Figure 108

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pg 2

Figure 109

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pg 1

```
package com.ibm.jtcx.serialization;

import java.io.IOException;
import java.io.ObjectInput;
import java.io.ObjectOutput;
/***
 * The interface for those classes that serialize objects to and from
 * a stream. The object that implements this interface should write
 * just the object's attributes, not any other descriptive information
 * about the object. Typically, a <code>SerializerIF</code> knows how
 * to serialize a specific class.
 */
public interface SerializerIF {
/***
 * Reads an object from the stream
 *
 * @return The object that was read.
 * @param in the input stream containing the object
 * @exception java.io.IOException thrown if the stream fails
 * @exception java.lang.ClassNotFoundException thrown if the stream
 * fails
 */
Object readObject(ObjectInput in) throws IOException, ClassNotFoundException;
/***
 * Writes the given object to the stream
 *
 * @param out the output stream into which the object will be written
 * @param element the object that will be written to the stream
 * @exception java.io.IOException thrown if the stream fails
 */
void writeObject(ObjectOutput out, Object element) throws IOException;
}
```

```
package com.ibm.jtcx.serialization;
```

```
import java.io.*;
import java.math.BigInteger;
import java.math.BigDecimal;
import java.util.Date;
import java.util.GregorianCalendar;
import java.util.Hashtable;
import java.util.SimpleTimeZone;
import java.util.StringTokenizer;
import java.util.TimeZone;
import java.util.Vector;

/**
 * The <code>SerializerIF</code> that is used as the base level
 * serializer. It contains three tables used to serialize objects:
 * <br><u>
 *   <li> codeTable: the table containing the serialization code of
 *   an object based on the name of the class
 *   <li> nameTable: the table containing the name of the class
 *   based on the serialization code
 *   <li> serializationTable: the table containing the serializer of
 *   an object based on its serialization code
 * </u>
 * <br><br>
 * <code>BaseSerializer</code> delegates the responsibility of
 * serializing the objects to the <code>SerializerIF</code> associated
 * with that class or to the object itself if it implements
 * <code>Externalizable</code>.
 */
public class BaseSerializer implements SerializerIF {
    static private final int NULL_OBJECT = 0;
    static private final int OTHER = 0x00ff;

    static private final String HASHTABLE_SER = "ClassNameHash.ser";
    static private final StringINI_FILE = "ClassNames.ini";

    static private Hashtable codeTable = null;
    static private Hashtable nameTable = null;
    static private Hashtable serializerTable = null;
    static private BaseSerializer instance = null;

    class BigDecimalSerializer implements SerializerIF {
        public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {

```

Figure 110

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pg 1

Figure 110

11000
pg 2

```
int scale = in.readShort();
int size = in.readShort();
byte[] bytes = new byte[size];
in.readFully(bytes);

BigInteger temp = new BigInteger(bytes);
return new BigDecimal(temp, scale);
}

public void writeObject(ObjectOutput out, Object element) throws IOException {
    BigDecimal bigD = (BigDecimal)element;

    int scale = bigD.scale();
    bigD.setScale(0);
    byte[] bytes = bigD.toBigInteger().toByteArray();
    bigD.setScale(scale);

    out.writeShort(scale);
    out.writeShort(bytes.length);
    out.write(bytes);
}

}

class BigIntegerSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException

        int size = in.readShort();
        byte[] bytes = new byte[size];
        in.readFully(bytes);

        return new BigInteger(bytes);
    }

    public void writeObject(ObjectOutput out, Object element) throws IOException {
        byte[] bytes = ((BigInteger)element).toByteArray();

        out.writeShort(bytes.length);
        out.write(bytes);
    }
}

class BooleanSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException

        int value = in.readByte();

        return (value == 1) ? Boolean.TRUE : Boolean.FALSE;
    }

    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeByte(((Boolean)element).booleanValue() ? 1 : 0);
    }
}
```

Figure 110

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pg 3

```
class ByteSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        byte value = in.readByte();

        return new Byte(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeByte(((Byte)element).byteValue());
    }
}
class CharacterSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        char value = in.readChar();

        return new Character(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeChar(((Character)element).charValue());
    }
}
class DateSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        long value = in.readLong();

        return new Date(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeLong(((Date)element).getTime());
    }
}
class DoubleSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        double value = in.readDouble();

        return new Double(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeDouble(((Double)element).doubleValue());
    }
}
```

Figure 110

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pg 4

```
class FloatSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        float value = in.readFloat();

        return new Float(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeFloat(((Float)element).floatValue());
    }
}
class GregorianCalendarSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        long time = in.readLong();
        Date date = new Date(time);
        SerializerIF serializer = BaseSerializer.getInstance();
        TimeZone tz = (TimeZone)serializer.readObject(in);

        GregorianCalendar gCalendar = new GregorianCalendar(tz);
        gCalendar.setTime(date);

        return gCalendar;
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        GregorianCalendar temp = (GregorianCalendar)element;

        Date date = temp.getTime();
        TimeZone tz = temp.getTimeZone();

        out.writeLong(date.getTime());
        SerializerIF serializer = BaseSerializer.getInstance();
        serializer.writeObject(out, tz);
    }
}
class IntegerSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        int value = in.readInt();

        return new Integer(value);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeInt(((Integer)element).intValue());
    }
}
class LongSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
```

Figure 110

```
long value = in.readLong();
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return new Long(value);
pg 5
}
public void writeObject(ObjectOutput out, Object element) throws IOException {
    out.writeLong(((Long)element).longValue());
}
}
class ObjectArraySerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        int size = in.readShort();

        Object[] array = new Object[size];
        for (int i = 0; i < size; i++) {
            SerializerIF serializer = BaseSerializer.getInstance();
            array[i] = serializer.readObject(in);
        }

        return array;
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        Object[] array = (Object[])element;

        out.writeShort(array.length);
        for (int i = 0; i < array.length; i++) {
            SerializerIF serializer = BaseSerializer.getInstance();
            serializer.writeObject(out, array[i]);
        }
    }
}
class ObjectSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        return in.readObject();
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        out.writeObject(element);
    }
}
class ShortSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        short value = in.readShort();

        return new Short(value);
    }
}
```

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pg 6

```
public void writeObject(ObjectOutput out, Object element) throws IOException {
    out.writeShort((Short)element.shortValue());
}
}

class SimpleTimeZoneSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        int offset = in.readInt();
        SerializerIF serializer = BaseSerializer.getInstance();
        String id = (String)serializer.readObject(in);

        return new SimpleTimeZone(offset, id);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        SimpleTimeZone temp = (SimpleTimeZone)element;

        out.writeInt(temp.getRawOffset());
        SerializerIF serializer = BaseSerializer.getInstance();
        serializer.writeObject(out, temp.getId());
    }
}

class StringSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        int size = in.readShort();
        byte[] bytes = new byte[size];
        in.readFully(bytes);

        return new String(bytes);
    }
    public void writeObject(ObjectOutput out, Object element) throws IOException {
        byte[] bytes = ((String)element).getBytes();

        out.writeShort(bytes.length);
        out.write(bytes);
    }
}

class VectorSerializer implements SerializerIF {
    public Object readObject(ObjectInput in) throws ClassNotFoundException, IOException {
        int size = in.readShort();

        Vector vector = new Vector(size);
        for (int i = 0; i < size; i++) {
            SerializerIF serializer = BaseSerializer.getInstance();
            vector.addElement(serializer.readObject(in));
        }
    }
}
```

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```
        return vector;
    }

    public void writeObject(ObjectOutput out, Object element) throws IOException {
        Vector temp = (Vector)element;

        Object[] array = new Object[temp.size()];
        for (int i = 0; i < array.length; i++) {
            array[i] = temp.elementAt(i);
        }

        out.writeShort(array.length);
        for (int i = 0; i < array.length; i++) {
            SerializerIF serializer = BaseSerializer.getInstance();
            serializer.writeObject(out, array[i]);
        }
    }

    /**
     * Default constructor. The constructor is private because this is a
     * singleton class. When the object is constructed, it initializes its
     * tables.
     */
    private BaseSerializer() {
        init();
    }

    /**
     * Adds the given elements to the three tables.
     *
     * @param className the name of the class
     * @param code the code for the given class
     * @param serializer the object responsible for serializing the given
     * class
     */
    private void addDataToTables(String className, Number code, SerializerIF serializer) {
        getCodeTable().put(code, className);
        getNameTable().put(className, code);

        if (serializer != null) {
            getSerializerTable().put(code, serializer);
        }
    }
}
```

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pg 8

```
/*
 * Creates the codes and serializer objects for the default serialization
 * classes and adds them to the tables. The tables are then written to
 * a serialized file.
 */
private void createDefaultTables() {
    addDataToTables(BigDecimal.class.getName(), new Byte((byte)1), new
BigDecimalSerializer());
    addDataToTables(BigInteger.class.getName(), new Byte((byte)2), new BigIntegerSerializer());
    addDataToTables(Boolean.class.getName(), new Byte((byte)3), new BooleanSerializer());
    addDataToTables(Byte.class.getName(), new Byte((byte)4), new ByteSerializer());
    addDataToTables(Character.class.getName(), new Byte((byte)5), new CharacterSerializer());
    addDataToTables(Date.class.getName(), new Byte((byte)6), new DateSerializer());
    addDataToTables(Double.class.getName(), new Byte((byte)7), new DoubleSerializer());
    addDataToTables(Float.class.getName(), new Byte((byte)8), new FloatSerializer());
    addDataToTables(GregorianCalendar.class.getName(), new Byte((byte)9), new
GregorianCalendarSerializer());
    addDataToTables(Integer.class.getName(), new Byte((byte)10), new IntegerSerializer());
    addDataToTables(Long.class.getName(), new Byte((byte)11), new LongSerializer());
    addDataToTables(Short.class.getName(), new Byte((byte)12), new ShortSerializer());
    addDataToTables(SimpleTimeZone.class.getName(), new Byte((byte)13), new
SimpleTimeZoneSerializer());
    addDataToTables(String.class.getName(), new Byte((byte)14), new StringSerializer());
    addDataToTables(Vector.class.getName(), new Byte((byte)15), new VectorSerializer());
    addDataToTables(Object.class.getName(), new Byte((byte)16), new ObjectSerializer());

    writeTables();
}
/*
 * Returns an instance of the table of class names, keyed by their code.
 * If the table does not exist, it is created.
 *
 * @return The table of class names.
 */
protected Hashtable getCodeTable() {
    if (codeTable == null) {
        codeTable = new Hashtable();
    }
}
```

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```
    return codeTable;
}

/** 
 * Returns an instance of <code>BaseSerializer</code>.
 *
 * @return An instance of <code>BaseSerializer</code>.
 */
public static SerializerIF getInstance() {
    if (instance == null) {
        instance = new BaseSerializer();
    }

    return instance;
}
/** 
 * Returns an instance of the table of codes, keyed by their
 * corresponding class name.
 * If the table does not exist, it is created.
 *
 * @return The table of codes.
 */
protected Hashtable getNameTable() {
    if (nameTable == null) {
        nameTable = new Hashtable();
    }

    return nameTable;
}
/** 
 * Returns an instance of the table of serializers, keyed by their
 * corresponding code.
 * If the table does not exist, it is created.
 *
 * @return The table of class names.
 */
protected Hashtable getSerializerTable() {
    if (serializerTable == null) {
        serializerTable = new Hashtable();
    }

    return serializerTable;
}
/** 
 * Initializes the hashtable from either a serialized hashtable or from
 * an ini file.
 */

```

```

protected void init() {
    File serializedFile = new File(HASHTABLE_SER);
    File iniFile = new File(INI_FILE);

    if (serializedFile.exists()) {
        readSerializedFile(serializedFile);
    } else {
        if (iniFile.exists()) {
            readIniFile(iniFile);
        }
    }

    createDefaultTables();
}

/**
 * Gets the value of the serialization code from the table based on
 * the className provided. The value returned can either be a
 * <code>Byte</code> or an <code>Integer</code>. The return value
 * will be a <code>Byte</code> if the className is one of the base
 * data types.
 *
 * @return The serialization code of the className.
 * @param className the name of the class
 */
private Number lookupCode(String className) {
    Number code = null;

    if (className != null) {
        code = (Number)getNameTable().get(className);
    }

    return code;
}
/**
 * Looks up the hashCode in the table and returns the String value of
 * the hashCode. If the hashCode does not exist in the table
 * <code>null</code> is returned.
 *
 * @return The object that was stored in the table with the given
 *         hashCode.
 * @param hashCode the hashCode that will be used to look up the value
 */

```

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pg 10

```

private String lookupName(Number code) {
    String className = null;

    if (code != null) {
        className = (String)getCodeTable().get(code);
    }

    return className;
}

/** 
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @return com.ibm.jtc.util.SerializerIF
 * @param code int
 */
private SerializerIF lookupSerializer(Number code) {
    SerializerIF serializer = null;

    if (code != null) {
        serializer = (SerializerIF)getSerializerTable().get(code);
    }

    return serializer;
}

/** 
 * Default method comment.
 *
 * <P>PRE:
 * <P>POST:
 *
 * @return Parameter not modified
 * @param iniFile java.io.File
 */
private void readIniFile(File iniFile) {
    BufferedReader in = null;

    try {
        in = new BufferedReader(new FileReader(iniFile));

        for (String inLine = in.readLine(); inLine != null; inLine = in.readLine()) {
            String trimLine = inLine.trim();
    }
}

```

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```

if ((trimLine.length() > 0) &&
    !trimLine.startsWith("#")) {
    StringTokenizer tokenizer = new StringTokenizer(trimLine);

    String className = tokenizer.nextToken();
    Integer code = new Integer(className.hashCode());
    SerializerIF serializer = null;

    if (tokenizer.hasMoreTokens()) {
        String serializerName = tokenizer.nextToken();

        try {
            serializer = (SerializerIF)Class.forName(serializerName).newInstance();
        } catch(Exception e) {}
    }

    addDataToTables(className, code, serializer);
}

} catch (Exception throwAway) {
} finally {
    try {
        in.close();
    } catch (Exception throwAway) {
    }
}

writeTables();
}

*/
* Reads the object from the stream by first reading the code for the
* element then reads the appropriate data for that object.
*
* @return The object that was read from the stream
* @param in the input stream that contains the object
*/
public Object readObject(ObjectInput in)
    throws ClassNotFoundException, IOException {
    Object retVal = null;
    Number code = null;

    byte baseCode = in.readByte();
}

```

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```
if (baseCode == NULL_OBJECT) {
    retVal = null;
} else {
    if (baseCode != OTHER) {
        code = new Byte(baseCode);
    } else {
        int secondCode = in.readInt();
        code = new Integer(secondCode);
    }

    SerializerIF serializer = lookupSerializer(code);
    if (serializer != null) {
        retVal = serializer.readObject(in);
    } else {
        String className = lookupName(code);

        try {
            retVal = Class.forName(className).newInstance();

            if (retVal instanceof Externalizable) {
                ((Externalizable)retVal).readExternal(in);
            } else {
                retVal = in.readObject();
            }
        } catch(Exception e) {
        }
    }
}

return retVal;
}
*/
* Reads the file containing the serialized hashtables of data.
*
* @param serializedFile the file containing the serialized tables
*/
private void readSerializedFile(File serializedFile) {
    ObjectInputStream in = null;
    try {
        in = new ObjectInputStream(new FileInputStream(serializedFile));
        codeTable = (Hashtable)in.readObject();
        nameTable = (Hashtable)in.readObject();
        serializerTable = (Hashtable)in.readObject();
    }
}
```

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```
    } catch (Exception throwAway) {
    } finally {
        try {
            in.close();
        } catch (Exception throwAway) { }

        if ((codeTable == null) ||
            (nameTable == null) ||
            (serializerTable == null)) {

            createDefaultTables();
        }
    }
}

/**
 * Writes the given object to the stream. First, the code representing
 * the type of the object is written, then the data within the object
 * is written.
 *
 * @param out the output stream that will contain the object
 * @param element the data object that will be written
 */
public void writeObject(ObjectOutput out, Object element)
throws IOException {

    if (element == null) {
        out.writeByte(NULL_OBJECT);
    } else {
        String className = element.getClass().getName();
        Number code = lookupCode(className);

        if (code != null) {
            if (code instanceof Byte) {
                out.writeByte(code.byteValue());
            } else if (code instanceof Integer) {
                out.writeByte(OTHER);
                out.writeInt(code.intValue());
            }
        }

        SerializerIF serializer = lookupSerializer(code);

        if (serializer != null) {
            serializer.writeObject(out, element);
        } else if (element instanceof Externalizable) {
            ((Externalizable)element).writeExternal(out);
        }
    }
}
```

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```
        } else {
            out.writeObject(element);
        }
    } else {
        if (element instanceof Object[]) {
            className = Object[].class.getName();
        } else {
            className = Object.class.getName();
        }
        code = lookupCode(className);
        SerializerIF serializer = lookupSerializer(code);

        out.writeByte(code.byteValue());
        serializer.writeObject(out, element);
    }
}
/** 
 * Writes the tables to the file.
 */
private void writeTables() {
    ObjectOutputStream out = null;

    try {
        File serFile = new File(HASHTABLE_SER);
        out = new ObjectOutputStream(new FileOutputStream(serFile));

        out.writeObject(getCodeTable());
        out.writeObject(getNameTable());
        out.writeObject(getSerializerTable());
        out.writeObject(new Date());
    } catch(Exception e) {
    } finally {
        try {
            out.close();
        } catch(Exception e) { }
    }
}
```

Figure 111

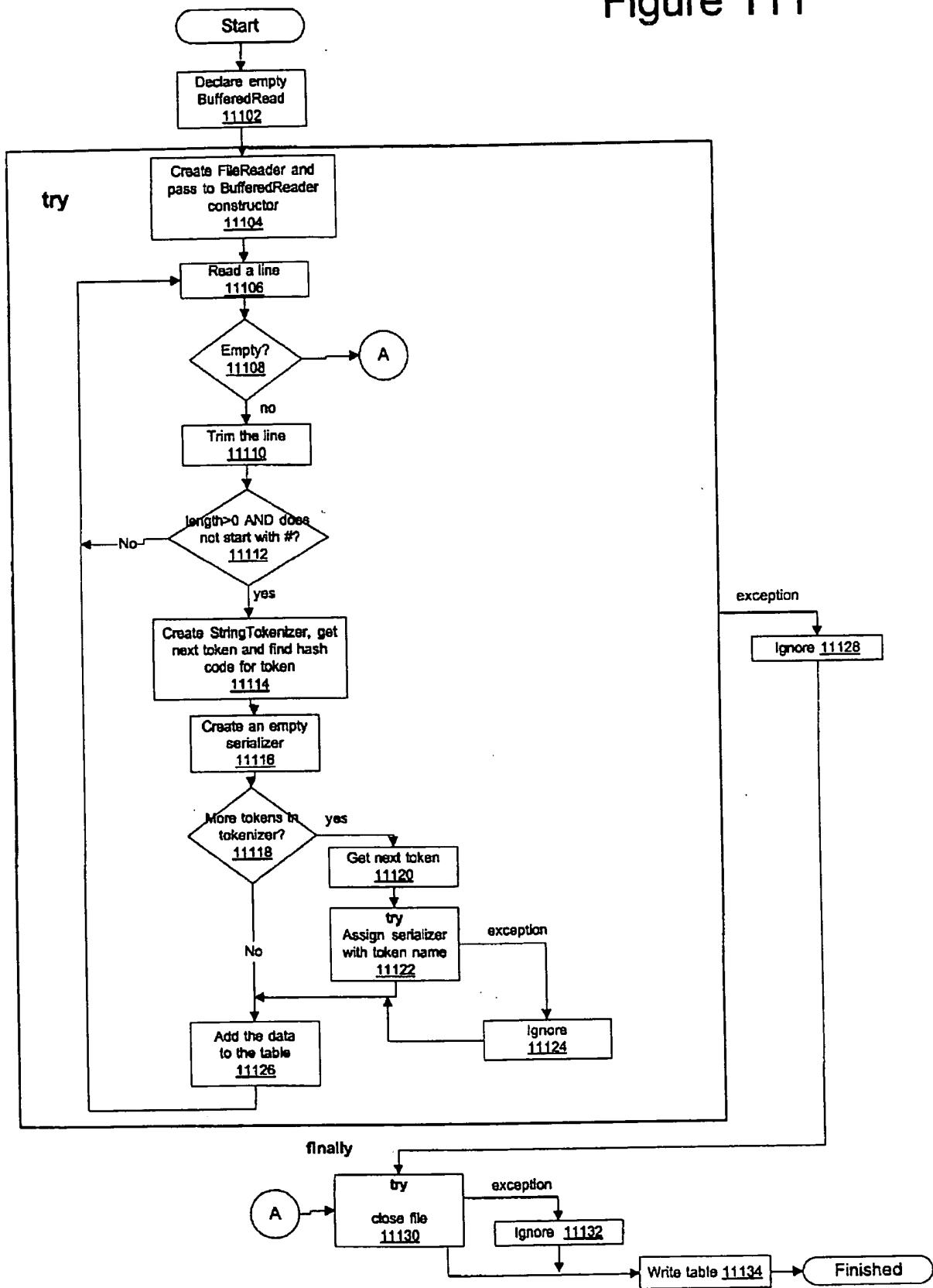


Figure 112
Getting/Setting
Permissions

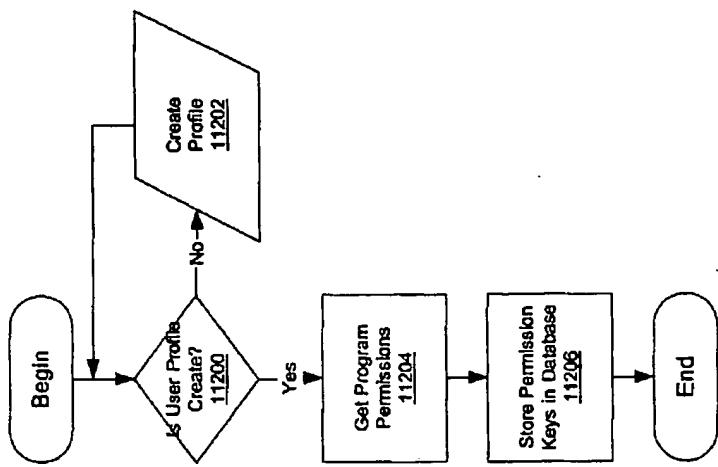


Figure 113
Getting/Setting
Permissions

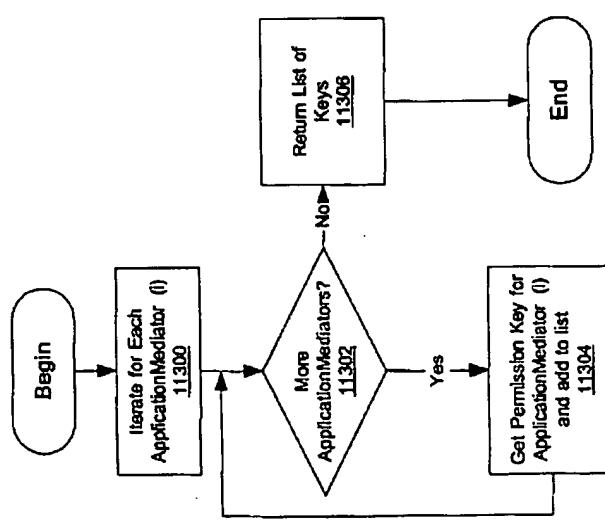


Figure 114
Getting/Setting
Permissions

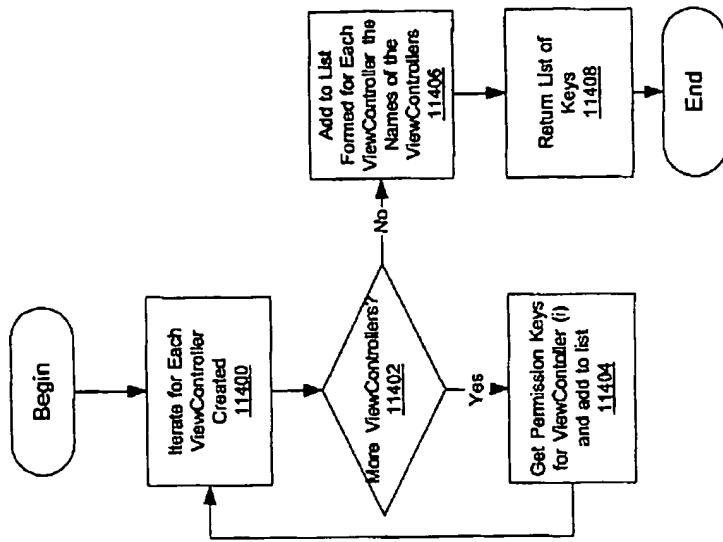


Figure 115
Getting/Setting
Permissions

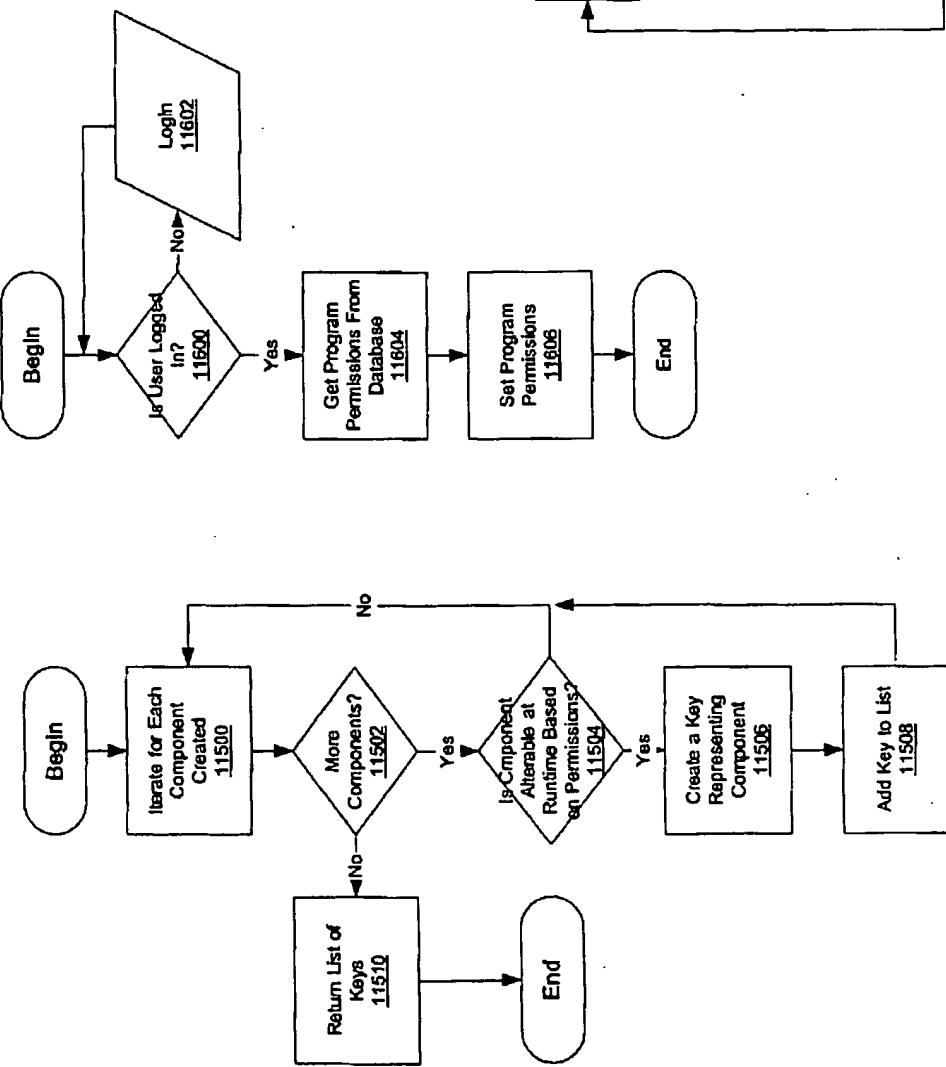


Figure 116
Getting/Setting
Permissions

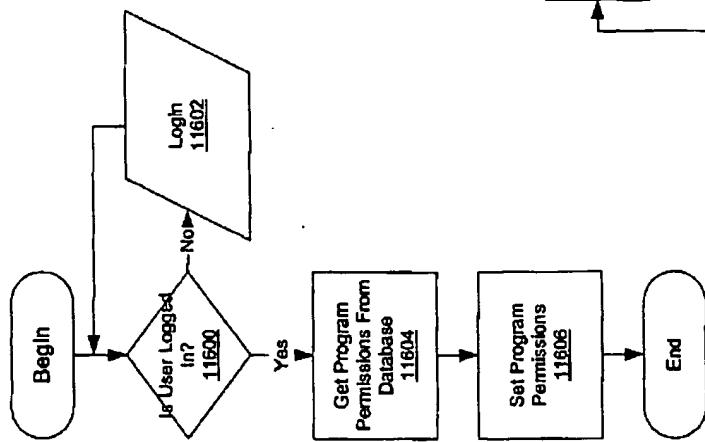


Figure 117
Getting/Setting
Permissions

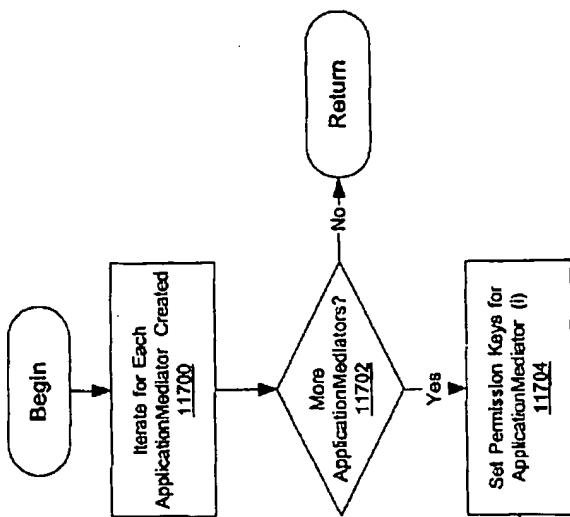


Figure 119
Getting/Setting
Permissions

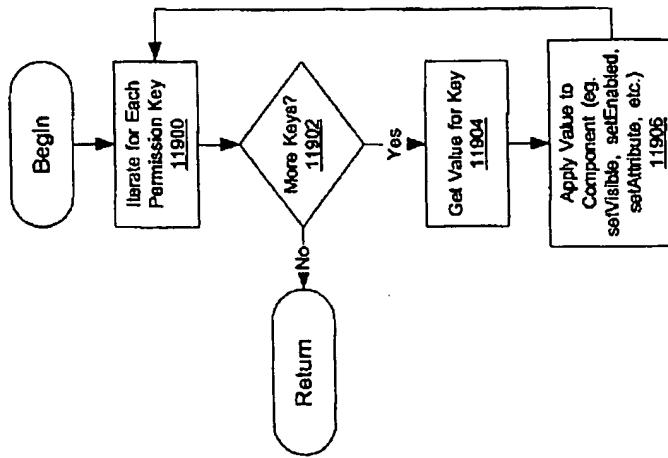
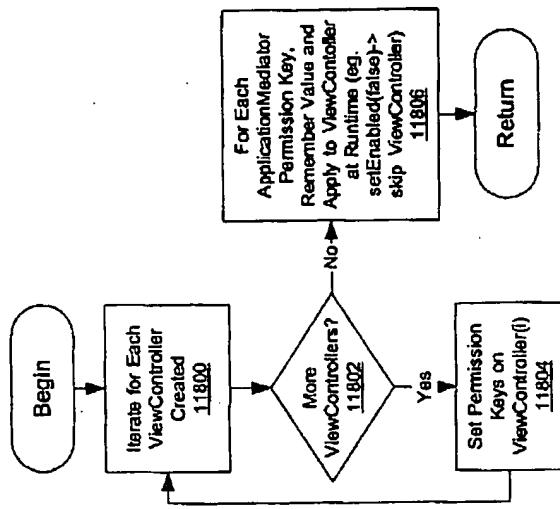
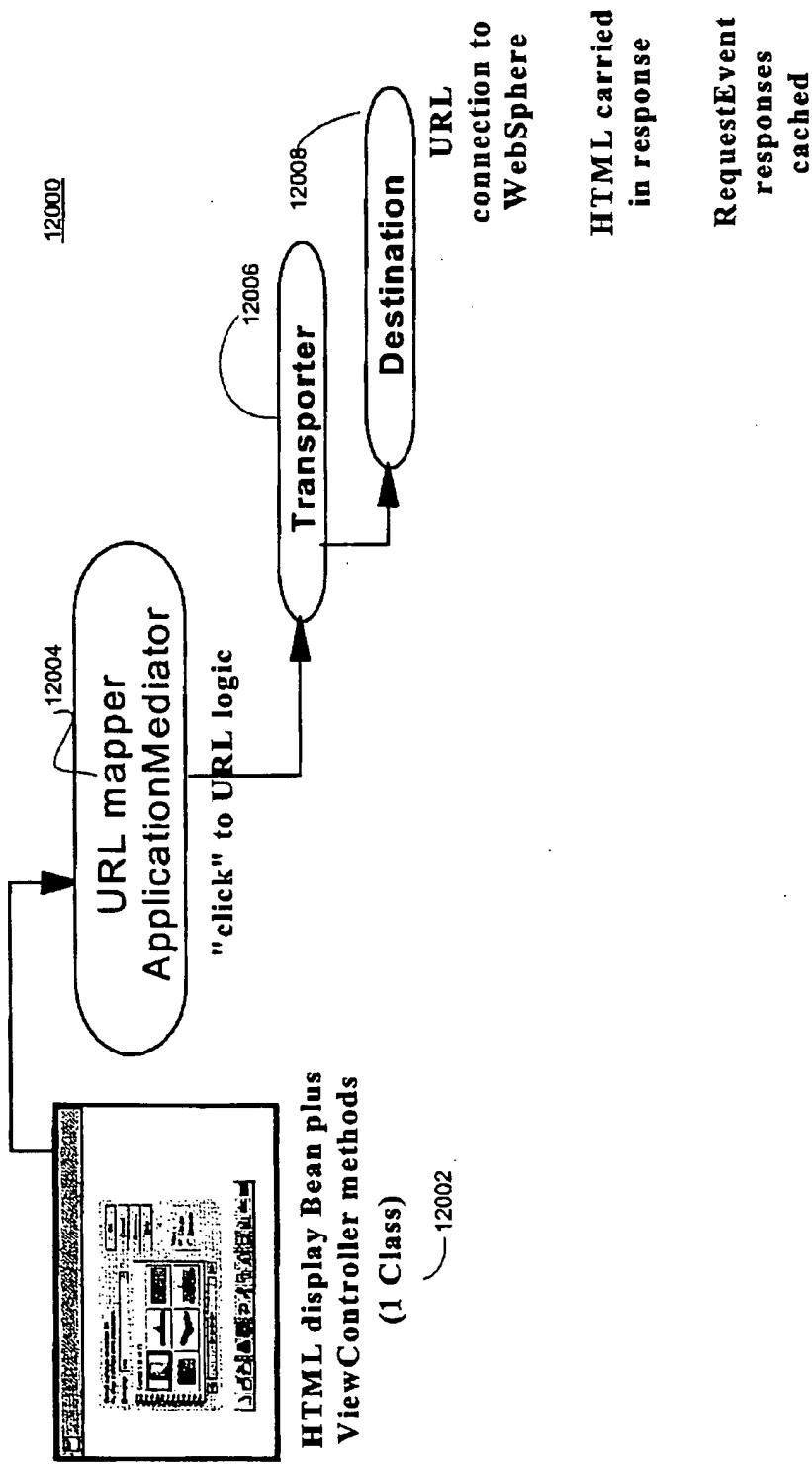


Figure 118
Getting/Setting
Permissions



Example Pattern FIGURE 120

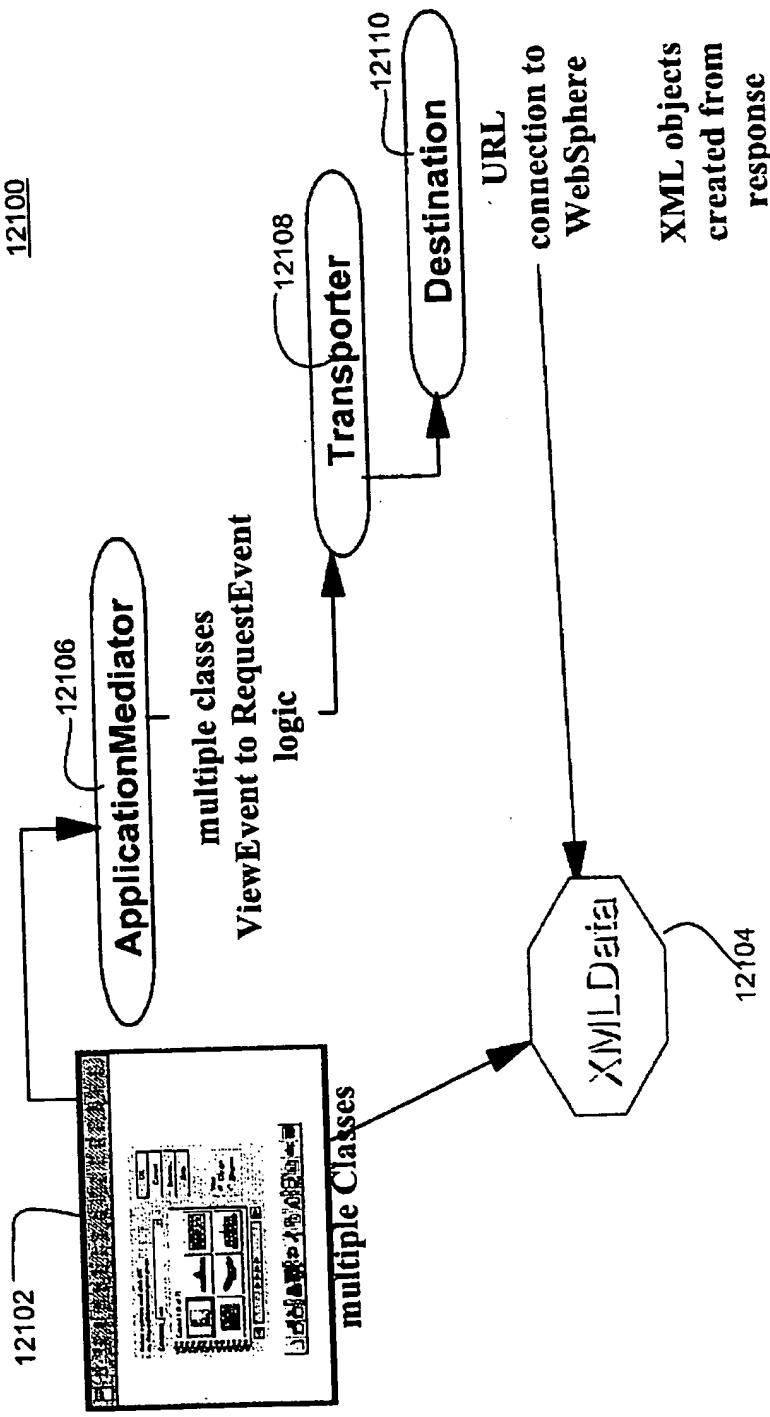
- Interpreted virtual screens
- Transactional with caching



Example Pattern

- Data models and ViewControllers
- Transactional

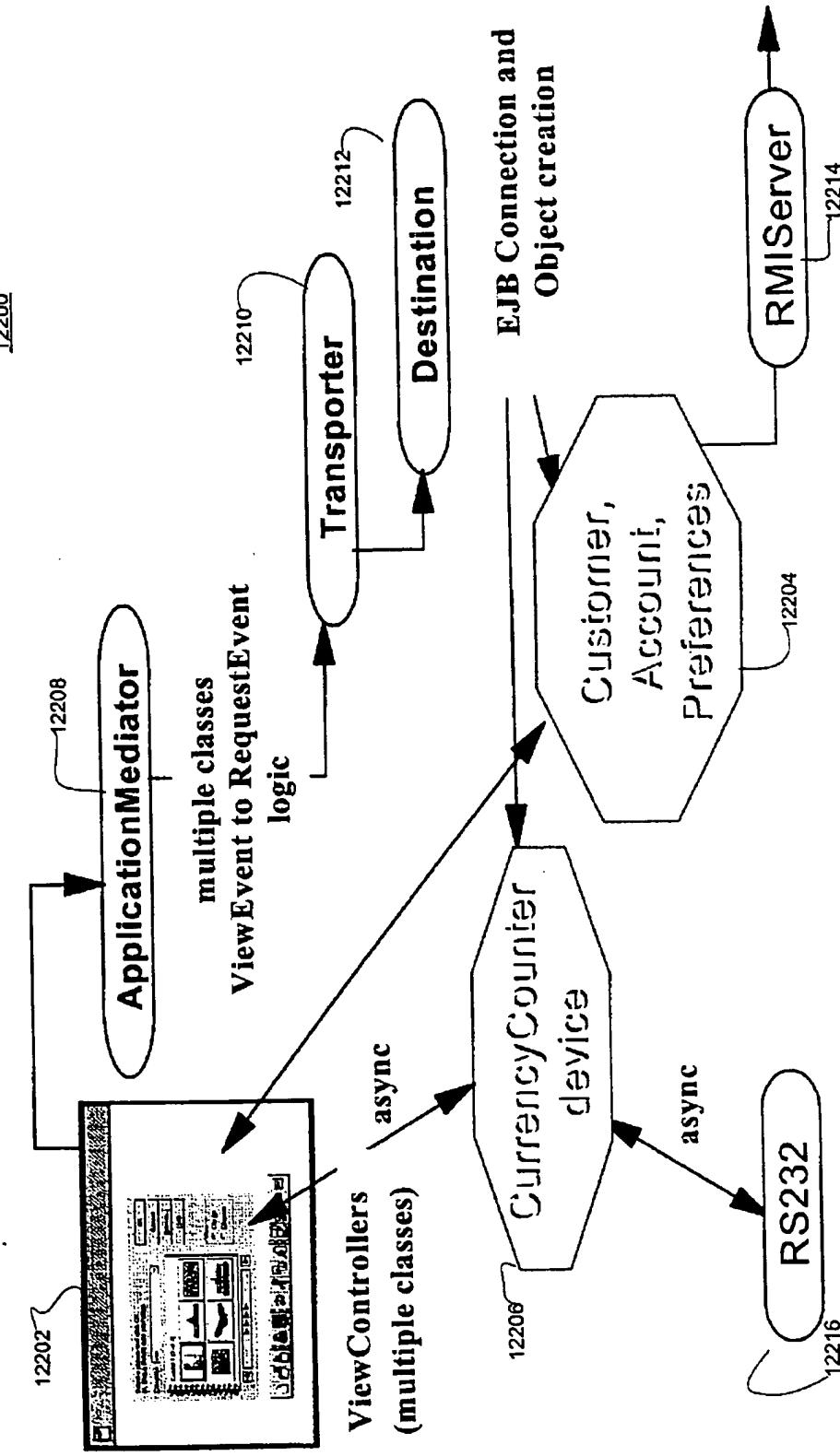
FIGURE 121



Example Pattern

- Live data objects
- Streaming and remote objects
- RequestEvents to turn on/off data objects

FIGURE 122



Example Pattern

→ Non-intrusive Caching, Tracing or Logging

FIGURE 123

